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THE FESTIVUS

A publication of the San Diego Shell Club

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Address all correspondence to the San Diego Shell Club, Inc., c/o 3883 Mt. Blackburn Ave., San Diego, CA 92111, USA.

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Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego

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PROGRAM

ABALONE AND THE FOSSIL RECORD: NO BALONEY

Lindsey Groves of the Natural History Museum of Los Angeles County will give a slide presentation on the history of *Haliotis* from the Late Cretaceous of southern California when it first appeared in the Recent. [This is the program that was canceled last July due to illness.]

Meeting date: January 20, 2011

CONTENTS

Club news 2
A 40-minute survey or the marine mollusks of the island of Saint Kitts, Leeward Islands, West Indies
SUSAN J. HEWITT 3
Octopuses drill crab chelae on the inside (oral side)
DANIEL H. BLUSTEIN 6
Low tides for 2011 at San Felipe, Baja California, México
JULES HERTZ, preparer 8
In Memoriam: Mary "Pecten" Flentz and Gladys Weber 8

CLUB NEWS

San Diego Shell Club Meeting Minutes
18 November 2010

The meeting was called to order by President Benjamin Pister at 7:35 PM. The Minutes were approved as published in *The Festivus* and treasurer Silvana Vollero reported the Club solvent and that dues for 2011 are now due. Vice President Jules Hertz listed the Club board's slate of officers and asked for nominations from the floor. There were none. The Club voted unanimously for the officers for 2011: President, Jules Hertz; Vice President, Bob Dees; Treasurer, Silvana Vollero; Recording Secretary, Paul Tuskes; Corresponding Secretary, Marilyn Goldammer. The new officers will be installed at the December Holiday Party (see col. 2).

Botanical Garden Foundation representative Wes Farmer reiterated that the Club's meeting room no longer has a custodian and that members must leave the room clean and in the order it was when we met.

Jules then introduced our speaker for the evening, Michael Hollmann, who gave an outstanding presentation on the Naticidae, tracing the group from the work of early taxonomists to the present time with the introduction of molecular analysis of DNA sequencing in determining species.

Michael had beautiful illustrations highlighting the morphological differences in species and the confusion in determining some species using this method. He used, as one of his examples, *Neverita duplicata* (Say, 1822), in taxonomic dispute through the years as to whether or not it should be one or two species. Morphologically, the two "forms" look very similar but for the subtle differences in the umbilical area – some specimens having a larger callus covering most of the smooth umbilical area and the other somewhat smaller, with greater relative height, and a stepped, grooved area entering the more open umbilicus. Molecular analysis finally solved the many years of questions and confirmed two species, with the smaller taking the name of one of the former synonyms, *Neverita delessertiana* (Récluz *in* Chenu, 1843).

Another one of the problems that Michael presented was that of the common *Naticarius onca* (Röding, 1798). DNA sequencing found there to be two species. There have been no morphological differences noted. This problem may require additional anatomical studies.

After this beautifully explained and illustrated presentation, Michael followed with an extra treat of a short video showing how the naticid moves while laying its eggs and forming the typical sand collar.

Following adjournment of the meeting, members and guests enjoyed the refreshments provided by Bob Dees, Marty Schuler and Wes Farmer and continued to chat with each other and about Michael's talk.

Carole Hertz

The Annual SCUM Meeting
January 21, 2011

The 15th annual SCUM meeting will be held on Saturday January 21st at the Southern California Coastal Water Research Project in Costa Mesa, from 9 AM (Meet and Greet with donuts & coffee) to the usual format of introductions and presentations beginning at 10 AM. After the lunch break, the meeting continues with presentations until about 3 PM..

SCUM (Southern California Unified Malacologists) is a relaxed meeting, free to all those interested, and the programs and presentations are always of interest.

For further info: e-mail kbarwick@ocsd.org. For directions: <http://www.sccwrp.org>.

Dues are Due

If you have not yet paid your dues for 2011, the time is now. The Club's membership roster comes out with the February issue of *The Festivus* and you must be a paid member to be listed on it.

Club's Annual Auction Date

The Club's auction 2011 will be on Saturday April 16th. Save the date – it's always the best fun!.

A 40-MINUTE SURVEY OF THE MARINE MOLLUSKS OF THE ISLAND OF SAINT KITTS, LEEWARD ISLANDS, WEST INDIES

SUSAN J. HEWITT*

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Saint Kitts, more formally known as Saint Christopher ("Kit" and "Kitt" being 18th century abbreviations for the name Christopher) is a small Caribbean island which forms part of the inner arc of the northern part of the Leeward Island chain, which in turn is part of the Lesser Antilles, in the West Indies (Map 1). The island is situated at 17°15'N, 62°40'W, between the islands of Sint Eustatius to the northwest, and Nevis to the southeast.

St. Kitts is a volcanic island about 68 square km in size. It is 29 km in length and about 8 km wide in its widest part. The population is about 35,000. St. Kitts is the larger of the two islands in the Federation of St. Kitts & Nevis. The marine mollusk fauna of St. Kitts has not been much investigated.

On April 19, 2009, my husband and I were traveling from New York to the island of Nevis for our annual visit. Our friend Jim Johnson of Nevis picked us up at the airport on St. Kitts. He drove us to the Sea Bridge ferry terminal on Major's Bay, which is at the southern end of the tip of the southeastern peninsula of St. Kitts, just across "The Narrows" from Nevis (Map 1). The Sea Bridge ferry runs every 2 hours, and when we arrived at the dock there were 50 minutes before the next departure, so I decided to search the sandy shore of the bay for shells. There was only a little beach drift, and much of the material consisted of broken shells and fragments, but I hand-picked as many different species of gastropods and bivalves as I could find in the time available. Unfortunately I was called to get onto the ferry before I had a chance to examine the rocky edges of the bay for live chitons, winkles, and nerites.

Results

The material included shells (or fragments of shells) of 44 marine mollusk species: 25 species of gastropods in 20 families, and 19 species of bivalves in 10 families.

Map 1. Caribbean area with inset showing position of St. Kitts and Nevis.

List of species collected

Gastropoda

Lottiidae:
- *Lottia* species "B" (as described in Hewitt, 2009)
- *Patelloida pustulata* (Helbling, 1779) including sea grass form

Fissurellidae:
- *Diodora viridula* (Lamarck, 1822)
- *Fissurella rosea* (Gmelin, 1791)

Trochidae:
- *Cittarium pica* (Linnaeus, 1758)
- *Tegula excavata* (Lamarck, 1822)
- *Tegula fasciata* (Born, 1778)

Turbinidae:
- *Turbo castanea* (Gmelin, 1791)

Phenacolepadidae:
- *Plesiothyreus hamillei* (P. Fischer, 1857)

Truncatellidae:
- *Truncatella pulchella* Pfeiffer, 1839

Cerithiidae:
Cerithium litteratum (Born, 1778)
Turritellidae:
Turritella variegata (Linnaeus, 1758)
Calyptraeidae:
Calyptraea centralis (Conrad, 1841)
Hipponicidae:
Hipponix subrufus (Lamarck, 1822)
Modulidae:
Modulus modulus (Linnaeus, 1758)
Naticidae:
Naticarius canrena (Linnaeus, 1758)
Tonnidae:
Cassis tuberosa (Linnaeus, 1758)
Eratoidae:
Pusula pediculus (Linnaeus, 1758)
Muricidae:
Mancinella deltoidea (Lamarck, 1822)
Fasciolariidae:
Fasciolaria tulipa (Linnaeus, 1758)
Leucozonia nassa (Gmelin, 1791)
Columbellidae:
Columbella mercatoria (Linnaeus, 1758)
Olividae:
Oliva reticularis Lamarck, 1811
Mitridae:
Mitra barbadensis (Gmelin, 1791)
Conidae:
Conus mus Hwass, 1792

Bivalvia

Arcidae:
Arca zebra (Swainson, 1833)
Acar domingensis (Lamarck, 1819)
Noetidae:
Arcopsis adamsi (Dall, 1886)
Glycymerididae:
Tucetona pectinata (Gmelin, 1791)
Pectinidae:
Argopecten nucleus (Born, 1778)
Lindapecten muscosus (W. Wood, 1828)
Chamidae:
Chama congregata Conrad, 1833
Chama florida Lamarck, 1819
Cardiidae:
Laevicardium serratum (Linnaeus, 1758
Lucinidae:
Codakia orbicularis (Linnaeus, 1758)
Cavilinga blanda (Dall, 1901)
Divaricella dentata (W. Wood, 1815)
Lucina pensylvanica (Linnaeus, 1758)
Parvilucina costata (d'Orbigny, 1846)
Ungulinidae:
Diplodonta nucleiformis (Wagner, 1840)
Tellinidae:
Strigilla pisiformis (Linnaeus, 1758)
Veneridae:
Gouldia cerina (C.B. Adams, 1845)
Macrocallista maculata (Linnaeus, 1758)
Pitar fulminatus (Menke, 1828)

Analysis

This list comprises rock-loving species (both cemented and nestling bivalves and gastropods that prefer rocky substrate) as well as a good number of infaunal bivalves. A selection of ten of the more intact shells is shown in Figure 1. The list is not surprising for a bay that is good-sized (1 km wide at the widest point), sandy and sheltered, but surrounded by rocks and cliffs.

Most of the species are unremarkable, but because the fauna of the Lesser Antilles has not been well studied, many of the records on this list help clarify or extend the range of species, especially those that are easily overlooked.

To give a few examples: one damaged shell of *Plesiothyreus hamillei* (a minute limpet in the superfamily Neritoidea) was found; according to Malacolog 4.1.1 this species occurs from Florida to Brazil; however within the Lesser Antilles, Malacolog only shows records from the Virgin Islands, Guadeloupe, and Tobago. According to the same source, within the Lesser Antilles, *Truncatella pulchella* has only been recorded from St. Thomas, in the Virgin Islands.

As for St. Kitts itself, Malacolog 4.1.1 lists 35 species as reported in the literature from this island. The list in this paper has 44 species. Perhaps surprisingly, the Malacolog list and the list in this paper have only three species in common: *Cittarium pica*, *Truncatella pulchella*, and *Parvilucina costata*. This means that 41 species on the current list are new records for St. Kitts. These 41 species are a useful addition to the knowledge of the marine mollusk fauna of this island.

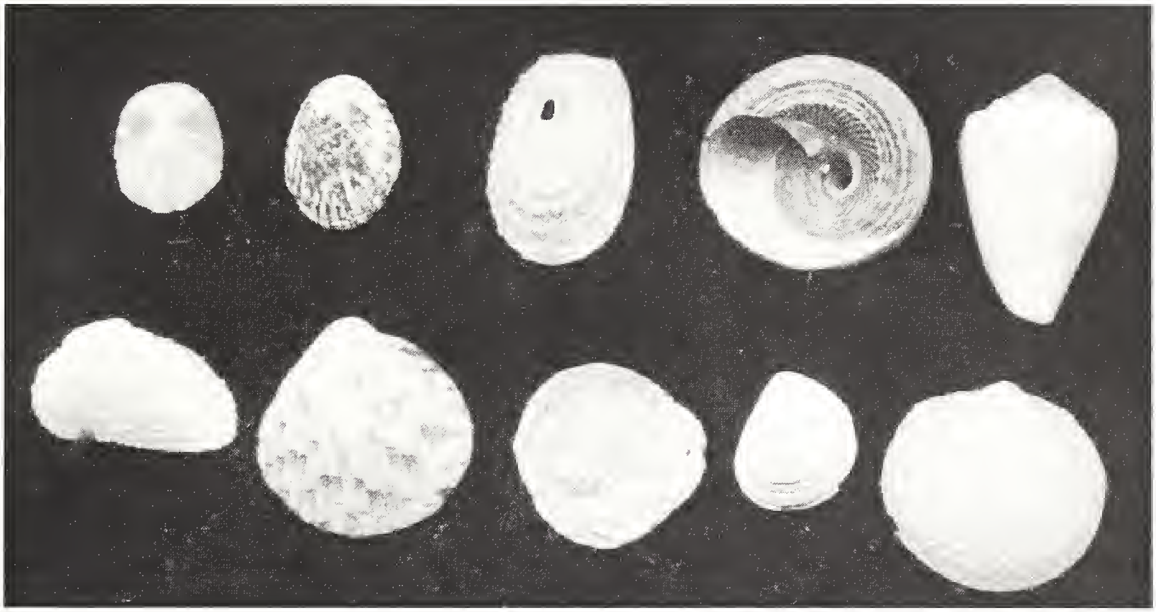

Figure 1: Beachworn shells from the drift in Major's Bay, St. Kitts, all to the same scale. The *Conus* shell is 13 mm long. From left to right, the gastropods are: *Patelloida pustulata* (sea grass form), *Lottia* sp "B" (as described in Hewitt 2009), *Diodora viridula*, *Tegula excavata*, and *Conus mus*. The bivalves are: *Acar domingensis*, *Tucetona pectinata*, *Chama florida*, *Cavilinga blanda*, and *Divaricella dentata*.

Acknowledgments

I wish to acknowledge gratefully the substantial help that the late Jim Johnson of Nevis gave me with my field work every year since 2000; sadly his life ended prematurely when his house burned down on April 13, 2010. The information from Gary Rosenberg's database Malacolog 4.1.1 is provided with the permission of the ANSP. The map and plate were assembled with expert help from Ron Hartley.

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OCTOPUSES DRILL CRAB CHELAE ON THE INSIDE (ORAL SIDE)

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The Caribbean shame-faced crabs *Calappa gallus* (Herbst, 1803) live mostly buried in the sand with their large, wide chelae held tightly over their mouths and mouth parts (Humann, 1992) (Figure 1). They are called "shame-faced" crabs because they appear to be hiding their "faces" with their chelae. They are a stout, compact crab with heavy carapaces up to 7.5 cm across. Octopuses eat *C. gallus* (Anderson et al., 2008) although their methods of finding the crabs and eating them are unknown. Based on the damage done to the crab shells in octopus middens, some insight into how octopuses access crab flesh might be gleaned.

During a recent two-week stay at Bonaire (1–15 May 2010), an island in the southern Caribbean, we had an opportunity to observe and collect midden items (food remains) from seven octopuses (*Octopus vulgaris* (Cuvier, 1797)) by snorkeling. Octopuses were spotted by the cleaned-shell remains in their middens (Wood & Anderson, 2009). Two had eaten *C. gallus* and continued to do so over the two weeks. We were able to collect and examine the crabs' carapaces and their heavy, wide chelae after octopuses had eaten them. We examined five carapaces for damage, looking particularly for drill holes as octopuses are able to drill crab carapaces with their radulae (Mather et al., 2010) in conjunction with an accessory boring organ that dissolves shell material chemically (Nixon & Maconnaughy, 1988). Venom injected by an octopus through a drill hole in the shell quickly paralyzes and kills the crab while also beginning external enzymatic digestion (Boyle, 1990).

None of the carapaces we found had drill holes in them and it is likely that the paralyzing venom was injected through the mouth area or arthrodial membranes at the joints as has been previously reported (Ballering et al., 1972). Of particular note was that of the 10 chelae examined, five were drilled (Figure 2). Octopuses are known to drill crab chelae (Mather & Nixon, 1995), presumably to aid removal of meat from the claws. The venom of the octopus releases the muscle attachments of the meat inside shelled prey and softens it for easy recovery (Boyle, 1990). Another interesting feature of the retrieved crab chelae was that they were drilled on the inside of the claws – the oral side facing their mouths. This location was previously termed "ventral" (Mather & Nixon, 1995) but the term may be inappropriate since the crabs hold their wide claws vertically in front of their faces. The oral side may present a more suitable drilling surface for the octopus compared to the knobby texture of the exterior side. Drilling of the oral side indicates that the chelae were most likely drilled after disarticulation from the crab, well after paralysis and death, in order to aid in meat retrieval. These observations support early evidence that injected venom may be used primarily to aid in digestion and is less important for immobilizing prey (Boyle 1990).

Acknowledgments

We thank Jennifer Mather for thoughtful discussion of this subject. This study was partially funded by an NSF Graduate Research Fellowship to DHB.

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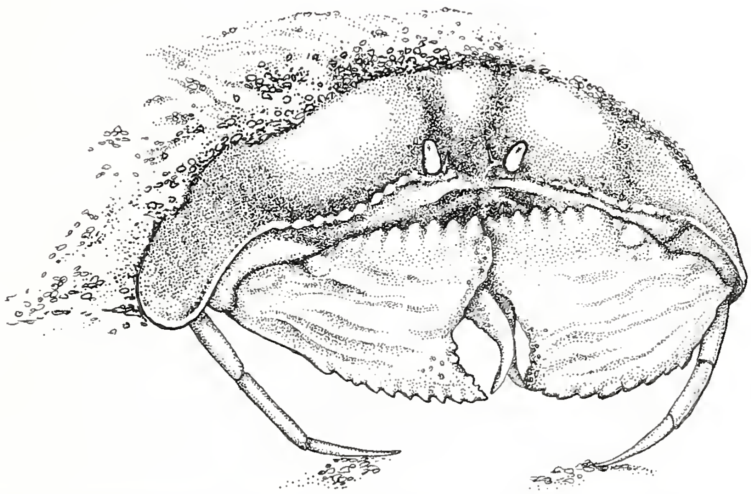

Figure 1. Shame-faced crab (*Calappa gallus*) with characteristic chela in front of the mouth. Illustration by Marla Coppolino.

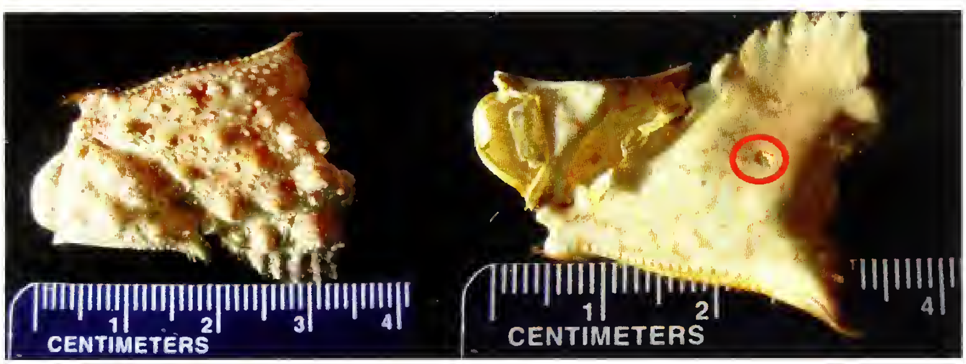

Figure 2. Aboral (left) and oral (right) views of a *C. gallus* chela found in an *Octopus vulgaris* midden. Note the drill hole on the oral side.

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LOW TIDES FOR 2011 AT SAN FELIPE, BAJA CALIFORNIA, MÉXICO

The entries below show periods of low tides of -3.90 feet and below. The times of low tides are given in Pacific Standard Time, except those dates marked with an asterisk which are in Pacific Daylight Time. To correct for Puerto Peñasco add one hour to listed times when they are in Pacific Standard Time. Tides below the midriff of the Gulf cannot be estimated using these entries. All entries are approximate times and tides.

Jan. 18	7:37 p.m.	-4.29 ft	Apr. 19	9:53 a.m*	-4.84 ft	Sep. 27	9:11 p.m*	-5.28 ft
Jan. 19	8:11 p.m.	-5.11 ft	May 15	7:37 a.m*	-3.90 ft	Sep. 28	9:47 p.m*	-5.14 ft
Jan. 20	8:50 p.m.	-5.23 ft	May 16	8:18 a.m*	-4.68 ft	Sep. 29	10:25 p.m*	-4.20 ft
Jan. 21	9:29 p.m.	-4.55 ft	May 17	8:58 a.m*	-4.82 ft	Oct. 24	7:33 p.m*	-3.97 ft
Feb. 16	7:20 p.m.	-4.60 ft	May 18	9:37 a.m.	-4.32 ft	Oct. 25	8:10 p.m*	-5.22 ft
Feb. 17	7:58 p.m.	-5.53 ft	June 15	8:47 a.m*	-3.98 ft	Oct. 26	8:49 p.m*	-5.74 ft
Feb. 18	8:37 p.m.	-5.60 ft	July 30	8:52 a.m*	-4.23 ft	Oct. 27	9:27 p.m*	-5.45 ft
Feb. 19	9:15 p.m.	-4.75 ft	July 31	9:29 a.m*	-4.64 ft	Oct. 28	10:07 p.m*	-4.40 ft
Mar. 17	8:02 p.m.*	-4.18 ft	Aug. 1	10:07 a.m*	-4.35 ft	Nov. 23	6:53 p.m.	-4.86 ft
Mar. 18	8:41 p.m.*	-4.96 ft	Aug. 28	8:35 a.m*	-4.72 ft	Nov. 24	7:34 p.m.	-5.36 ft
Mar. 19	9:21 p.m.*	-4.79 ft	Aug. 29	9:12 a.m*	-5.06 ft	Nov. 25	8:15 p.m.	-5.16 ft
Mar. 20	7:39 a.m.*	-5.20 ft	Aug. 29	9:37 p.m*	-3.94 ft	Nov. 26	8:56 p.m.	-4.29 ft
Mar. 20	10:00 pm*	-3.90 ft	Aug. 30	9:50 a.m*	-4.56 ft	Dec. 22	6:45 p.m.	-3.91 ft
Mar. 21	10:15 am*	-4.80 ft	Aug. 30	10:12 p.m*	-4.01 ft	Dec. 23	7:29 p.m.	-4.59 ft
Apr. 16	8:01 a.m*	-4.17 ft	Sep. 26	8:15 a.m*	-4.35 ft	Dec. 24	8:10 p.m.	-4.68ft
Apr. 17	8:38 a.m*	-5.16 ft	Sep. 26	8:35 p.m*	-4.63 ft	Dec. 25	8:49 p.m.	-4.16 ft
Apr. 18	9:15 a.m*	-5.39 ft	Sep. 27	8:54 a.m*	-4.52 ft			

Compiled by Jules Hertz

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1916-2010

Gladys Weber

1914-2010

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PROGRAM

Las Conchas Azules (The Blue Shells): Father Kino, Abalones, and the Island of California.

Hans Bertsch, a specialist in opisthobranchs and the marine life of the Panamic Province will present an illustrated program including some of the history and fauna of the areas in the northern Golfo de California.

Meeting date: February 17, 2011

CONTENTS

Club news 10
First records of twenty species of Turridae (Mollusca) in Perú, with notes on three other species
Valentín Mogollón & Grace Victoria Montalván 11
Minus tides in San Diego for remainder of 2011
Paul Tuskes, compiler 26

San Diego Shell Club Membership Roster for 2011 for detaching

CLUB NEWS

San Diego Shell Club Meeting Minutes
20 January 2011

The meeting was called to order at 7:45 P.M. by Vice President Bob Dees, The previous minutes were accepted as published. Marilyn Goldammer gave the corresponding secretary's report and as librarian encouraged members to use the library. The treasurer was absent so there was no report. Carole Hertz asked everyone to keep Saturday April 16th open as that is the day of the annual shell auction. More information on the auction in February and March.

Carole Hertz introduced our speaker Lindsey Groves, who is collection manager of malacology at the Natural History Museum of Los Angeles County. Lindsey spoke about the history of fossil abalone. He stated that currently there are approximately 54 living species of abalone. The oldest known abalone fossil is from the Cretaceous, approximately 78 million years ago and was found in Southern California along with the next two oldest fossil abalone. All of the early abalone were small, usually less that 10 mm in length.

Abalone fossils do not show up in the rest of the world until the Miocene, 30 million years ago. Thirty-five species of extinct abalone have been named. Our Southern California abalone species are documented in Pliocene deposits. Sometimes the abalone is fossilized and other times the mud in the shell becomes rock and the shell deteriorates leaving a cast of the inside portion of the shell. Most current and past species of abalone are small to moderate-sized species, but large species occur in southern Africa, Australia, parts of Asia, California and Baja. The evolution of the genus is not clear. The current center of species diversity is in Indonesia, but there are no fossils from that area. Southern California has by far the oldest fossil records, but the group of shells that abalone are thought to have evolved from are not known from the west coast fossil record.

A third idea is that abalone developed in what is now northern Europe, but at that time it would have been a tropical-subtropical sea. The fossil record for the group that abalone may have evolved from are known from that area... but there are no truly old fossil abalone from Europe. So, until the Way-Back machine which Dr. Peabody used to the visit historical figures is re-found (as seen on Rocky and Bullwinkle) ... we just have to wait.

Paul Tuskes

SCUM XV
Southern California Unified Malacologists
Rescheduled

The annual SCUM meeting which had been canceled in January due to a power outage has been rescheduled for Saturday March 5th and will begin as usual at 9:00 A.M.

The meeting will still be held at the Southern California Coastal Water Research Project, 3535 Harbor Blvd, Suite 110, Costa Mesa, CA. For directions, go to: http://www.sccwrp.org/ContactUs/Directions.aspx

TO ALL OUR SHELLING FRIENDS

YOU ARE CORDIALLY INVITED TO ATTEND THE SAN DIEGO SHELL CLUB'S ANNUAL AUCTION/POTLUCK ON SATURDAY EVENING, APRIL 16TH

Bring family and friends – the shells will be fantastic!!!

The San Diego Shell Club's annual auction/potluck will be held on Saturday evening April 16th in the Community Room of Wes Farmer's condo at 3591 Ruffin Rd., San Diego, 92123 [Maps can be provided, if needed]. The festivities will begin at 5 P.M., with dinner at 6 P.M. and the voice auction starting promptly at 7 P.M..

Among some of the very special items for auction are a number of excellent books and many beautiful shells. Among them are *Chiton goodalli* and *sulcatus* from the Galápagos; *Cypraea nigropunctata*, *fultoni*, *rabaulensis*, *teuleri*, *rashleighana* and *gaskoini;* trophons *bentleyi*, *truncatus*, *clathratus*, *albispinosus* ; *Strombus taurus* and *helli; Cinclidotyphis myrae*; and *Pteropurpura centrifuga*. – plus MANY more. Besides the voice auction, there will be a wonderful silent auction and a humongous $1 table.

If you are unable to attend and want to be a part of this important fundraiser and exciting event, you can request an auction list by mailing jhertz@san.rr.com and a list will be sent to you. Should you wish to bid on any items, an attending member will bid for you following your instructions.

Proceeds from this biggest social event of the year help support *The Festivus*, Club library, donations toward student grants, the San Diego Science Fair as well as the Club's social functions. HOPE YOU CAN ATTEND!!

FIRST RECORDS OF TWENTY SPECIES OF TURRIDAE (MOLLUSCA) IN PERÚ, WITH NOTES ON THREE OTHER SPECIES

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Abstract: Twenty species of marine gastropods of the family Turridae are recorded for the first time in Peruvian waters: *Polystira nobilis* (Hinds, 1843); *Crassispira (Dallspira) erigone* (Dall, 1919); *Crassispira (Striospira) coracina* McLean & Poorman, 1971; *Miraclathurella mendozana* (Shasky, 1971); *Carinodrillia halis* (Dall,1919); *Compsodrillia alcestis* (Dall, 1919); *Compsodrillia bicarinata* (Shasky, 1961); *Compsodrillia undatichorda* McLean & Poorman, 1971; *Compsodrillia* sp.; *Microdrillia tersa* Woodring, 1928; *Cymakra* sp.; *Clathurella* sp.; *Nannodiella fraternalis* (Dall, 1919), *Nannodiella nana* (Dall, 1919), *Glyphostoma (G.) bayeri* Olsson, 1971; *Glyphostoma (G.) neglecta* (Hinds, 1843); *Kurtziella (K.) antiochroa* (Pilsbry & Lowe, 1932); *Kurtziella (R.) powelli* Shasky, 1971; *Glyptaesopus phylira* (Dall, 1919) and *Platycythara electra* (Dall, 1919). Additionally, three other little-known species in our waters are studied: *Drillia (D.) roseola* (Hertlein & Strong, 1955); *Crassispira (Striospira) adana* (Bartsch, 1950) and *Crassispira (Striospira) nigerrima* (Sowerby, 1834). New distributional records and habitat data are given for all species.

Introduction

Tryon (1884) and Dall (1909) recorded *Agathotoma ordinaria* (E. A. Smith, 1882) in Peruvian waters. Peña (1970) extended the southern distribution (without figures) of *Pilsbryspira aterrima* (Sowerby, 1834) and *Pilsbryspira collaris* (Sowerby, 1834) (as *Crassispira nephele* Dall, 1919) to Puerto Zorritos and Caleta Bocapán, Tumbes, Perú. McLean (*in* Keen, 1971) added three other species of Turridae: *Agladrillia pudica* (Hinds, 1843) to Isla Lobos de Tierra, Lambayeque, Perú, *Anticlinura peruviana* (Dall, 1908) and *Xanthodaphne egregia* (Dall, 1908) without specific localities. In 1987, Alamo and Valdivieso added *Hormospira libya* (Dall, 1919) (as *Tiariturris libya*, p. 83), *Gemmula hindsiana* Berry, 1958 (p. 83), *Cochlespira cedonulli* (Reeve, 1843, p. 84), *Knefastia pilsbryi* (Lowe, 1935, p. 84, fig. 176), *Knefastia princeps* Berry, 1953 (p. 84), *Knefastia* sp. (p. 84), *Aforia goodei* (Dall, 1890, p. 84, fig. 177), *Leucosyrinx clionella* Dall, 1908 (p. 84, fig. 179), *Hindsiclava resina* (Dall, 1908, p. 84), *Ptychobela lavinia* (Dall, 1919, p. 87) and *Strombinoturris crockeri* Hertlein & Strong, 1951 (p. 87). Peña (1989) recorded two other species: *Gemmula chilensis* (Berry, 1968) (as *Ptychosyrinx chilensis*, p. 76, fig. 21) and *Crassispira cortezi* Shasky & Campbell, 1964 (p. 76, fig. 22). Emerson (1991), recorded *Microdaphne trichodes* (Dall, 1919), as collected by McLean (1976), at Isla Lobos de Afuera, Lambayeque, in 1.5-9 m depth. Shasky (1996) extended the southern distribution of *Crassispira bifurca* (E. A. Smith, 1888); *Agathotoma finitima* (Pilsbry & Lowe, 1932); and *Agathotoma stellata* (Mörch, 1860) to Playa El Rubio, and *Kurtziella beta* (Dall, 1919) and *Kurtzia arteaga* (Dall & Bartsch, 1910) to Caleta La Cruz, both localities in Tumbes. In 1997, this author recorded *Tenaturris merita* (Hinds, 1843) and *Notocytharella striosa* (C. B. Adams, 1852) in Playa El Rubio. Mogollón et al. (2000: 66-67, figs. 3-4), added *Doxospira hertleini* Shasky, 1971, which was dredged off Punta Malpelo, Tumbes. Another four species were added by Mogollón (2001): *Hormospira spectabilis* (Berry, 1958, p. 104, figs. 6-7); *Polystira oxytropis* (Sowerby, 1834, p. 105, figs. 14-15); *Crassispira maura* (Sowerby, 1824, p. 106, figs. 12-13); and *Crassispira turricula* (Sowerby, 1834, p. 106, figs. 1-2). In 2002, Peña and Mogollón, recorded another two species found in northern Perú: *Crassispira adana* (Bartsch, 1950, p. 6, figs. 18-19) and *Bellacythara bella* (Hinds, 1843, p. 7, figs. 20-21). Mogollón and Montalván (2004), added *Drillia roseola* (Hertlein & Strong, 1955), and *Crassispira nigerrima* (Sowerby, 1834). Finally, Paredes et al. (2009) recorded *Carinodrillia adonis* Pilsbry & Lowe, 1932, from Cabo

Blanco, Piura. With the twenty new records added herein, the count becomes 57 species of Turridae found in Peruvian waters.

The material herein studied was collected in northern Perú, during the years 1989 to 2010, between Isla Lobos de Tierra, Lambayeque to off Puerto Pizarro, Tumbes. The species were all self-collected, unless otherwise noted. The systematic arrangement is according to McLean (*in* Keen, 1971), as modified by Skoglund (2002).

Collections Studied

CAA: Carlos Arias Avila Collection, Lima, Perú.
CS: Carol Skoglund Collection, Phoenix, Arizona, USA. [now in the Santa Barbara Museum of Natural History, Santa Barbara, California]
CST: Carlos Schreier Terreros Collection, Lima, Perú.
GMPG: Gregorio Mario Peña Gonzáles Collection, Lima Perú.
VMA: Valentín Mogollón Avila Collection, Lima, Perú.

Table 1. Coordinates of Peruvian localities mentioned in text.

Locality	Lat. S	Long. W
Playa El Bendito	3° 25.5'	80° 18.0'
Islilla Hueso de Ballena	3° 29.0'	80° 22.0'
Puerto Pizarro	3° 30.0'	80° 23.0'
Punta Malpelo	3° 30.1'	80° 30.0'
Caleta La Cruz	3° 37.8'	80° 35.0'
Puerto de Zorritos	3° 40.0'	80° 39.5'
Caleta Bocapán	3° 42.0'	80° 43.5'
Playa El Rubio	3° 51.0'	80° 50.0'
Caleta Cancas	3° 56.5'	80° 56.5'
Caleta Máncora	4° 06.1'	81° 03.2'
Caleta Cabo Blanco	4° 15.1'	81° 13.9'
Isla Lobos de Tierra	6° 26.0'	80° 51.0'
Isla Lobos de Afuera	6° 55.5'	80° 42.5'

Source: HIDRONAV-34, Second Edition, 1987. Callao, Perú.

SYSTEMATICS

Superfamily CONOIDEA
Family TURRIDAE Swainson, 1840
Subfamily DRILLINAE Morrison, 1966
Genus *Drillia* Gray, 1838
Subgenus *Drillia*, *s.s.*

***Drillia* (*D.*) *roseola* (Hertlein & Strong, 1955)**
(Figure 2)

Cymatosyrinx roseola Hertlein & Strong, Bulletin of the American Museum of Natural History 107(2): 221-223, pl. 2, fig. 27 (1955).
Synonym: *Pleurotoma rosea* Sowerby, 1834, not Quoy & Gaimard, 1833.

Material studied:
- Caleta Máncora, Piura, Perú, two live specimens, 15-20 m depth, mud and little sand; 23.1 x 9.5 mm (Figure 2) (CS) and 7.6 x 3.1 mm (VMA). August 7, 2003.
- Caleta Cancas, Tumbes, Perú, one live specimen, 20-25 m depth, mud, 9.5 mm height, May 22, 2006 (VMA).
- Puerto Pizarro, Tumbes, Perú, one dead specimen, in 32 m depth, coarse sand and gravel, 20 x 6 mm (CS). July 30, 2008.
- Puerto Pizarro, Tumbes, Perú, one dead specimen, in 32 m, coarse sand; 21.1 x 8.5 mm (VMA). February 11, 2009.

Published distribution: Golfo de Tehuantepec, M xico; Bahía Octavia, Colombia, and off Cabo Pasado, Ecuador (Hertlein & Strong, 1955); Head of the Golfo de California, M xico, to Bahía Santa Elena, Ecuador, 10-55 m (McLean, *in* Keen, 1971); Bahía San Carlos, Guaymas, Sonora, M xico (Poorman & Poorman, 1988); off Caleta Máncora, Piura Dept, Perú, 15-20 m (Mogollón & Montalván, 2004).

New localities: Caleta Máncora, Piura, and Caleta Cancas and Puerto Pizarro, Tumbes, Perú.

Remarks: This species is uncommon in Peruvian waters, and was recorded for the first time in Perú by Mogollón & Montalván (2004).

Subfamily TURRINAE
Genus *Polystira* Woodring, 1928

***Polystira nobilis* (Hinds, 1843)**
(Figure 1)

Pleurotoma nobilis Hinds, Proceedings of the Zoological Society of London, Part XI, p. 37 (March 28, 1843).

Material studied:
– Puerto Pizarro, Tumbes, Perú, one dead specimen, shrimp trawled, 20-25 m, coarse sand; 81.5 x 25.1 mm (Figure 1) (CST). January 18, 2007.

Published distribution: Head of the Golfo de California, M xico to Panamá, to 165 m (McLean, *in* Keen, 1971).

New locality: Puerto Pizarro, Tumbes, Perú, in 20-25 m.

Remarks: This species is one of the largest American turrids and is recorded for the first time in South America.

Subfamily CRASSISPIRINAE
Genus *Crassispira* Swainson, 1840
Subgenus *Dallspira* Bartsch, 1950

***Crassispira (D.) erigone* Dall, 1919**
(Figure 3)

Crassispira erigone Dall, Proceedings of the United States National Museum 56 (2288): 21, pl. 7, fig. 8 (for 1920).

Material studied:
– Puerto Pizarro, Tumbes, Perú, one dead specimen, shrimp trawled, 20-25 m, mud and sand; 21.5 x 8.9 mm (Figure 3) (CS). January 18, 2007. Leg. Carlos Arias Avila.

Published distribution: Guaymas, Sonora, M xico, to Cabo San Francisco, Ecuador, in 20 to 50 m (McLean, *in* Keen, 1971).

New locality: Puerto Pizarro, Tumbes, Perú, in 20-25 m.

Subgenus *Striospira* Bartsch, 1950

***Crassispira (S.) adana* (Bartsch, 1950)**
(Figure 4)

Adanaclava adana Bartsch, The Nautilus 63(3): 87-88, pl. 6, fig. 4 (Jan. 1950).

Material studied:
– Caleta La Cruz, Tumbes, Perú, one dead specimen, shrimp-trawled, 20-25 m, mud and sand; 14 x 5.6 mm (GMPG). January 1989.
– Caleta Bocapán, Tumbes, Perú, intertidal under rocks, two specimens, 12-14 mm in height (GMPG). February 1992.
– Punta Malpelo, Tumbes, Perú, one live specimen, 20-30 m, mud and sand, 18 x 6.5 mm (Figure 4) (CS). May 17, 2006.
– Puerto Pizarro, Tumbes, Perú, one dead specimen, very eroded, 30-32 m, sand and ground shells; 14 x 6 mm (VMA). October 31, 2008.
– Puerto Pizarro, Tumbes, Perú, one live, dredged specimen, 30-32 m, sand, 17.2 x 6.4 mm (VMA). November 16, 2008.

Published distribution: Mazatlán, Sinaloa M xico, to Panamá (McLean, *in* Keen, 1971); off Bahía San Carlos, Sonora, M xico (Poorman & Poorman, 1988); Caleta Bocapán and off Caleta La Cruz, Tumbes, Perú (Peña & Mogollón, 2002).

New Localities: Punta Malpelo, near mouth of Río Tumbes, and Puerto Pizarro, both at Tumbes, Perú.

Remarks: The type figured by Bartsch (1950, pl. 6, fig. 4), is a subadult specimen of 12.2 mm height, and was collected by Lowe at Manzanillo, Colima, M xico. This species was recorded for the first time in Perú by Peña & Mogollón (2002).

***Crassispira (S.) coracina* McLean & Poorman, 1971**
(Figure 5)

Crassispira (Striospira) coracina McLean & Poorman, The Veliger 14(1): 100-101, fig. 26 (July 1, 1971).

Material studied:
- Puerto Pizarro, Tumbes, Perú, one live specimen, 15-20 m, mud; 17.9 x 7.2 mm (Figure 5) (CS). January 20, 2004.

Published distribution: El Pulmo, Baja California, M xico, to Bahía Panamá (McLean, *in* Keen, 1971).

New Locality: Puerto Pizarro, Tumbes, Perú, in 15-10 m.

***Crassispira (S.) nigerrima* (Sowerby, 1833)**
(Figure 6)

Pleurotoma nigerrima Sowerby, Proceedings of the Zoological Society of London, Part I, p. 137 (Dec. 9, 1833).
Synonym: *Pleurotoma cornuta* Sowerby, 1834.

Material studied:
- Near Islilla Hueso de Ballena, off Puerto Pizarro, Tumbes, Perú, three live specimens, 7-10 m depth, mud and mangrove detritus; 22 x 8.5 mm (Figure 6) (CS), 21.8 x 8.6 mm and 18.3 x 9.1 mm (without first whorls) (VMA). June 6, 2002.
- Caleta Máncora, Piura, Perú, one live specimen, 15-20 m depth, mud and sand, 20.4 x 9.3 mm (without first whorls) (VMA). August 7, 2003.
- Caleta Máncora, Piura, Perú, two live immature specimens, 10-15 m depth, mud and sand; 14.6 x 6.4 mm, and 14.7 x 6.1 mm (VMA). August 4, 2004.
- Caleta Cancas, Tumbes, Perú, one live specimen, 20-25 m, mud; 20.4 x 8.7 mm (VMA). May 22, 2006.

Published distribution: Cabo San Lucas, Baja California, M xico, to Bahía Santa Elena, Ecuador (McLean, *in* Keen, 1971); Isla Gorgona, Colombia (Cosel, 1984); Caleta Máncora, Piura Dept., and El Bendito and Islilla Hueso de Ballena, Tumbes Dept, Perú (Mogollón & Montalván, 2004).

New Locality: Caleta Cancas, Tumbes, Perú.

Remarks: This species was recorded for the first time in Peruvian waters by Mogollón & Montalván (2004).

Genus *Miraclathurella* Woodring, 1928

***Miraclathurella mendozana* Shasky, 1971**
(Figure 7)

Miraclathurella mendozana Shasky, The Veliger 14(1): 68, fig. 2 (July 1, 1971).

Material studied:
- Caleta La Cruz, Tumbes, Perú, two dead specimens, 40-50 m depth, mud, 13.9 x 4.9 mm (first whorls lost) (Figure 7) (CS) and 12.1 x 4.6 mm (VMA). May 20, 2005.

Published distribution: Golfo de Tehuantepec, M xico (Type locality), between 37-73 m (Shasky, 1971); Isla Espíritu Santo, Golfo de California, M xico to Bahía Cupica, Colombia, in 40-130 m (McLean *in* Keen, 1971).

New locality: Caleta La Cruz, Tumbes, Perú, in 40-50 m depth.

Genus *Carinodrillia* Dall, 1919

***Carinodrillia halis* (Dall, 1919)**
(Figure 8)

Clathrodrillia (Carinodrillia) halis Dall, Proceedings of the United States National Museum 56 (2288): 17-18, pl. 5, fig. 4 (for 1920).

Material studied:
- Puerto Pizarro, Tumbes, Perú, one dead specimen, in 32 m depth, coarse sand and gravel, 20 x 6 mm (Figure 8) (CS). July 30, 2008.
- Puerto Pizarro, Tumbes, Perú, one dead specimen, in 30-32 m depth, coarse sand and gravel, 24.5 mm height (VMA). June 4, 2009.

Published distribution: Puertecitos, near the head of the Golfo de California, M xico, to Peninsula Santa Elena, Ecuador (McLean *in* Keen, 1971).

New locality: Puerto Pizarro, Tumbes, Perú, in 32 m, coarse sand and gravel.

Subfamily ZONULISPIRINAE
Genus *Compsodrillia* Woodring, 1928

***Compsodrillia alcestis* (Dall, 1919)**
(Figure 9)

Clathrodrillia (Carinodrillia) alcestis Dall, Proceedings of the United States National Museum 56 (2288): 18, pl. 5, fig. 6 (for 1920).
Synonym: *Carinodrillia dariena* Olsson, 1971.

Material studied:
- Puerto Pizarro, Tumbes, Perú, one dead dredged

specimen, in 20 m, mud and mangrove detritus, 24.3 x 8 mm (Figure 9) (CS). May 9, 2003.

Published distribution: Guaymas, Sonora, M xico to Puerto Utría, Colombia, in 40 to 90 m (McLean *in* Keen, 1971); Roca Consag, Golfo de California, M xico (DuShane & Brennan, 1969); Punta Estrella, San Felipe, Baja California, M xico (Gemmell, Hertz & Myers, 1980).

New locality: Puerto Pizarro, Tumbes, Perú, in 20 m depth.

Remarks: This species appears to be close to *Carinodrillia halis* (Dall, 1919), which it resembles. Olsson (1971), studied a number of specimens collected in the Golfo de Panamá, which appear to be more common.

Compsodrillia bicarinata (Shasky, 1961)

(Figure 10)

Clathrodrillia (*Carinodrillia*) *bicarinata* Shasky, The Veliger 4(1): 21, pl. 4, fig. 10 (July 1, 1961).

Material studied:

- Puerto Pizarro, Tumbes, Perú, two dead specimens, 20-30 m depth, sandy mud; 35.2 x 14.3 mm (first whorls lost) and 26.6 x 7.3 mm (VMA). August 8, 2003.
- Puerto Pizarro, Tumbes, Perú, one dead specimen, 20-30 m depth, sandy mud; 37.9 x 12.8 mm (VMA). August 28, 2004.
- Puerto Pizarro, Tumbes, Perú, one dead specimen, 20 m depth, mud and mangrove detritus; 28.2 x 9.3 mm (Figure 10) (CS). January 18, 2007.

Published distribution: Guaymas, Sonora, M xico, to Isla La Plata, Ecuador (McLean *in* Keen, 1971).

New locality: Puerto Pizarro, Tumbes, Perú, in 20-30 m depth, bottom of sandy mud, mud, and mangrove detritus.

Compsodrillia undatichorda McLean & Poorman, 1971

(Figure 11)

Compsodrillia undatichorda McLean & Poorman, The Veliger, 14(1): 104-105, fig. 34. (July 1, 1971).

Material studied:

- Puerto Pizarro, Tumbes, Perú, one live specimen, in 32 m, gravel and coarse sand (CS). February 6, 2002.
- Isla Lobos de Tierra, Lambayeque, Perú, one dead specimen, 20-25 m, sand; 11.8 x 4.5 mm (Figure 11) (VMA). April 21, 2002.
- Caleta La Cruz, Tumbes, Perú, one live specimen, 40-45 m, mud, 13.6 x 4.5 mm (VMA). May 20, 2005.

Published distribution: Islas Galápagos, Ecuador, in 80-150 m (McLean *in* Keen, 1971).

New localities: Isla Lobos de Tierra, Lambayeque, Perú, in 20-25 m and Puerto Pizarro, Tumbes, in 32 m.

Remarks: Judging distribution, this species appears somewhat restricted to the southern extreme of the Panamic Province.

Compsodrillia sp.

(Figure 12)

Material studied:

- Caleta Máncora, Piura, Perú, one live specimen, collected adhering to old net tangled in a crab trap, 180-200 m depth, 18 x 5.8 mm (Figure 12) (CS). October 26, 2004.

Remarks: This fine *Compsodrillia* (genus was identified by Mrs. Carol Skoglund of Phoenix, Arizona), is possibly an undescribed species. Several other species of mollusks and echinoderms were collected with this species, attached to the same old net.

Subfamily BORSONIINAE

Genus *Microdrillia* Casey, 1903

Microdrillia tersa Woodring, 1928

(Figure 13)

Microdrillia tersa Woodring, Carnegie Institution of Washington, Publication N° 385, p. 197, pl. 8, fig. 14 (1928).

Material studied:

- Punta Malpelo, Tumbes, Perú, one specimen dead (apex broken), 32 m, on coarse, sand-ground shells; 7.6 x 2.5 mm (CS). June 2, 2002.
- El Bendito, near the mouth of Río Zarumilla, Tumbes, Perú, three live specimens, in 7-10 m depth, mud and mangrove detritus; 10.5 x 3.4 mm, 10.1 x 3.2 mm (Figure 13) and 10.2 x 3.2 mm (VMA). May 18, 2006.
- Puerto Pizarro, Tumbes, Perú, one dead specimen, in 32 m depth, coarse sand and gravel; 10.2 x 3.1 mm (VMA). December 22, 2009.

Published distribution: Specimen collected by Allan Hancock Expedition in Panamá in 22 m was actually from Isla Secas, Chiriquí Province (Skoglund, 1998); Fort Amador, Canal Zone, Panamá, intertidal (Shasky, 1997); extend distribution north to Bahía Santiago, Colima, M xico, between 8-20 m (Skoglund, 1998).

New localities: Punta Malpelo, El Bendito and Puerto Pizarro, all in Tumbes, Perú, in 7-32 m depth.

Remarks: It was described from the Miocene of Bowden, Jamaica. The first specimen of this species recorded in the eastern Pacific was collected in Panamá, from 22 m depth by the Allan Hancock Expedition to the Islas Galapagos, 1931-1932 (Shasky, 1997) although Strong & Hertlein (1940) did not list this species. This specimen, housed in the Natural History Museum of Los Angeles County (Skoglund, 1998), was previously identified by Dr. James McLean (Shasky, 1997).

Genus *Cymakra* Gardner, 1937

***Cymakra* sp.**
(Figure 14)

Material studied:

- Caleta Máncora, Piura, Perú, two live specimens, 180-200 m depth, attached to an old trawl net, tangled in a crab trap; 6.4 x 3.1 mm (apex lost) (Figure 14) (CS) and 6.3 x 3.0 mm (VMA). October 26, 2004.

Remarks: This small species is easily identified by the subsutural row of alternating white and brown nodules. It was collected with *Compsodrillia* sp., and also could be an undescribed species.

Subfamily CLATHURELLINAE

Genus *Clathurella* Carpenter, 1857

***Clathurella* sp.**
(Figure 15)

Material studied:

- Caleta Máncora, Piura, one live specimen, 180-200 m depth, attached to an old trawl net, tangled in a crab trap; 10.3 x 5.0 mm (Figure 15) (CS). October 26, 2004.

Remarks: This fine *Clathurella* has strong spiral sculpture and shouldered whorls and was collected together with *Compsodrillia* sp, and *Cymakra* sp., and like them, could be an undescribed species.

Genus *Nannodiella* Dall, 1919

***Nannodiella fraternalis* (Dall, 1919)**
(Figure 16)

Philbertia (*Nannodiella*) *fraternalis* Dall, Proceedings of the United States National Museum 56 (2288): 60, pl. 20, fig. 5 (for 1920).

Material studied:

- Punta Malpelo, Tumbes, one specimen dead (apex broken), 32 m, on coarse sand ground shells; 4.6 x 1.9 mm (CS). June 02, 2002.
- Puerto Pizarro, Tumbes, one dead specimen (immature, lip thin), 30-32 m, on coarse sand; 4.0 x 1.5 mm (VMA). October 13, 2003.
- Puerto Pizarro, Tumbes, one live specimen, 30-32 m, on coarse sand; 4.0 x 1.8 mm (VMA). August 29, 2008.
- Puerto Pizarro, Tumbes, one live specimen, 30-32 m, on coarse sand; 4.1 x 1.8 mm (VMA). February 11, 2009.
- Puerto Pizarro, Tumbes, one live specimen, 30-32 m, on coarse sand and ground shells, 4.2 x 1.7 mm (Figure 16) (VMA). April 7, 2009.
- Puerto Pizarro, Tumbes, one dead specimen, 30-32 m, on coarse sand and ground shells, 3.9 x 1.8 mm (VMA). May 12, 2010.

Published distribution: Puertecitos, Golfo de California, M xico to Isla Gorgona, Colombia, in 20 to 70 m (McLean *in* Keen, 1971). Extend distribution south to Manabí Province, Ecuador (Shasky, 1984).

New localities: Punta Malpelo and Puerto Pizarro, both in Tumbes, Perú, in 30-32 m depth.

Nannodiella nana **(Dall, 1919)**
(Figure 17)

Philbertia (*Nannodiella*) *nana* Dall, Proceedings of the United States National Museum 56 (2288): 59-60, pl. 20, fig. 7 (for 1920).

Material studied:
- Punta Malpelo, Tumbes, Perú, nine specimens, 30 m depth, coarse sand and mud; 3.2 x 1.4 and 3.4 x 1.5 mm (CS); 2.9 x 1.2, 2.9 x 1.2, 3.1 x 1.3, 3.3 x 1.3, 2.9 x 1.3, 3.2 x 1.3 and 3.4 x 1.5 (VMA). June 2, 2002.
- Puerto Pizarro, Tumbes, Perú, three dead specimens, 30-32 m depth, coarse sand; 3.0 x 1.3, 2.6 x 1.2 and 2.5 x 1.2 mm (VMA). May 16, 2006.
- Islilla Hueso de Ballena, near Puerto Pizarro, Tumbes, Perú, one dead, immature specimen, 7 m depth, mud and mangrove detritus; 2.5 x 1.1 mm (VMA). May 18, 2006.
- Puerto Pizarro, Tumbes, Perú, four specimens, 30-32 m depth, coarse sand and ground shells; 3.0 x 1.3 mm (dead), 3.1 x 1.3 mm (dead), 3.2 x 1.3 mm (live) and 3.3 x 1.4 mm (live) (VMA). May 2, 2008.
- Puerto Pizarro, Tumbes, Perú, one live specimen, immature (lip thin), 30-32 m depth, coarse sand and ground shells; 2.8 x 1.2 mm (VMA). June 8, 2008.
- Puerto Pizarro, Tumbes, Perú, one live specimen, 30-32 m depth, coarse sand and ground shells; 3.0 x 1.3 mm (Figure 17) (VMA). February 11, 2009.
- Puerto Pizarro, Tumbes, Perú, one live specimen, 30-32 m depth, coarse sand and ground shells; 2.5 x 1.1 mm (VMA). December 5, 2009.
- Puerto Pizarro, Tumbes, Perú, two dead specimens, 30-32 m depth, coarse sand and ground shells; both 2.9 x 1.2 mm (VMA). January 10, 2010.
- Puerto Zorritos, Tumbes, Perú, more than 200 specimens dredged in 50-65 m depth, acid mud. bottom (VMA).Several dates during the past ten years.

Published distribution: Bahía San Luis Gonzaga, Golfo de California, to Isla Gorgona, Colombia, in 20-70 m (McLean *in* Keen, 1971); Manabí Province, Ecuador (Shasky, 1984); Isla del Coco, Costa Rica, in 61 m (Shasky, 1996).

New localities: Puerto Zorritos, Punta Malpelo, Islilla Hueso de Ballena, and Puerto Pizarro, all in Tumbes, Perú, in 7-65 m depth.

Remarks: This small species is common in the samples taken off Puerto Zorritos, Tumbes, in 50-65 m depth, mud bottom. Sometimes we found 50 specimens per square meter. Most specimens from this zone are eroded by acid mud.

Genus *Glyphostoma* Gabb, 1872
Subgenus *Glyphostoma, s. s.*

Glyphostoma **(***G.***)** *bayeri* **Olsson, 1971**
(Figure, 18)

Glyphostoma bayeri Olsson, Bulletin of Marine Science 21(1): 49-50, figs. 14-15 (1971).

Material studied:
- Puerto Pizarro, Tumbes, Perú, one dead specimen, in 30-32 m depth, coarse sand and gravel; 19.3 x 7.6 mm (VMA). January 8, 2010.
- Puerto Pizarro, Tumbes, Perú, one dead dredged specimen, in 30-32 m depth, coarse sand and gravel; 20.8 x 8.6 mm (Figure 18) (VMA). February 5, 2010.

Published distribution: Golfo de Nicoya, Costa Rica, to Puerto Utría, Colombia, in 30-80 m (McLean *in* Keen, 1971).

New locality: Puerto Pizarro, Tumbes, Perú, in 30-32 m.

Glyphostoma **(***G.***)** *neglecta* **(Hinds, 1843)**
(Figure 19)

Clavatula neglecta Hinds, Proceedings of the Zoological Society of London, Part XI, p. 45 (March 28, 1843).
Synonyms: *Defrancia intercalaris* Carpenter, 1856; *Clathurella aurea* Carpenter, 1857; *Glyphostoma adria* and *G. adana* Dall, 1919; *Lioglyphostoma armstrongi* Hertlein & Strong, 1951; *Glyphostoma myrakeenae* Olsson, 1964.

Material studied:
- Puerto Zorritos, Tumbes, Perú, one dead, immature specimen, 35 m, mud and sand; 5.1 x 2.0 mm (VMA). June 4, 2002.

- Piedra Redonda, Caleta Cancas, Tumbes, Perú, one dead specimen, 30-35 m, mud; 7.3 x 2.6 mm (VMA). June 5, 2002.
- Caleta Máncora, Piura, Perú, one live immature specimen, 10 m, mud and sand; 6.3 x 2.4 mm (VMA). June 5, 2002.
- Caleta Máncora, Piura, Perú, one live specimen, 15-20 m, mud and sand; 8.0 x 2.6 mm (VMA). August 7, 2003.
- Caleta Máncora, Piura, Perú, nine specimens, 10-20 m, mud and sand; 10.4 x 4.0 mm (CS), 9.8 x 3.8, 11.5 x 3.2, 9.6 x 3.3, 7.1 x 2.9, 9.2 x 3.1, 8.4 x 3.2, 10.8 x 3.4 and 7.8 x 2.9 mm (VMA). August 5, 2004.
- Islilla Hueso de Ballena, near Puerto Pizarro, Tumbes, Perú, one dead immature specimen, 7-10 m, mud and mangrove detritus; 6.6 x 2.6 mm (VMA). August 6, 2004.
- Islilla Hueso de Ballena, near Puerto Pizarro, Tumbes, Perú, three immature specimens (lips thin), 7 m, mud and mangrove detritus; 9.7 x 3.3, 7.3 x 3.0 and 6.1 x 2.5 mm (VMA). May 18, 2006.
- Puerto Pizarro, Tumbes, Perú, one live specimen, 30-32 m, coarse sand; 12.5 x 4.5 mm (Figure 19) (VMA). February 11, 2009.

Published distribution: Head of the Golfo de California to Peninsula Santa Elena, Ecuador, in 20-50 m (McLean *in* Keen, 1971).

New localities: Caleta Máncora, Piura, and Piedra Redonda, near Cancas, Puerto Zorritos, Islilla Hueso de Ballena, and Puerto Pizarro, Tumbes, Perú, in 7-35 m depth.

Subfamily MANGELIINAE
Genus *Kurtziella* Dall, 1918
Subgenus *Kurtziella, s. s.*

Kurtziella (*K.*) *antiochroa* (Pilsbry & Lowe, 1932)
(Figure 20)

"Mangelia" antiochroa Pilsbry & Lowe, Proceedings of the Academy of Natural Sciences of Philadelphia 84: 56, pl. 3, fig. 8 (1932).
Synonym: *Mangelia cymatias* Pilsbry & Lowe, 1932.

Material studied:
- Punta Malpelo, Tumbes, Perú, one dead immature specimen, 30 m, mud and sand; 4.5 x 1.9 mm (VMA). June 2, 2002.
- Puerto Zorritos, Tumbes, Perú, two specimens, 30-35 m, mud and sand; 6.7 x 2.4 and 6.9 x 2.3 mm (VMA). June 4, 2002.
- Caleta Máncora, Piura, Perú, five live specimens, 10 m, mud and sand; 8.7 x 2.9 mm (CS), 7.0 x 2.5 (Figure 20), 5.5 x 2.0, 6.0 x 2.1 and 5.9 x 2.0 mm (VMA). August 5, 2004.
- Caleta La Cruz, Tumbes, Perú, two specimens, 30 m, mud; 4.7 x 1.7 and 7.5 x 2.2 mm (VMA). May 26, 2005.
- Puerto Pizarro, Tumbes, Perú, one specimen, 30-32 m, coarse sand; 6.6 x 2.5 (VMA). May 16, 2006.
- Islilla Hueso de Ballena, near Puerto Pizarro, Tumbes, Perú, three specimens, 7-10 m, mud and mangrove detritus; 6.3 x 2.4, 7.0 x 2.4 and 7.1 x 2.3 mm (VMA). May 16, 2006.
- Puerto Zorritos, Tumbes, Perú, two specimens, 20-30 m, mud; 7.1 x 2.4 and 7.7 x 2.8 mm (Figure 20) (VMA). February 4, 2007.
- Caleta La Cruz, Tumbes, Perú, two specimens, 20-30 m, mud; 4.6 x 2.0 and 6.2 x 2.3 mm (VMA). February 6, 2007.
- Puerto Zorritos, Tumbes, one live specimen, 40 m, mud and sand; 5.5 x 2.0 mm (VMA). April 9, 2010.

Published distribution: Head of the Golfo de California to La Libertad, Ecuador, in 10-50 m (McLean *in* Keen, 1971).

New localities: Caleta Máncora, Piura Dept, and Puerto Zorritos, Caleta La Cruz, Punta Malpelo, Islilla Hueso de Ballena, and Puerto Pizarro, Tumbes, Perú.

Subgenus *Rubellatoma* Bartsch & Rehder, 1939

Kurtziella (*R.*) *powelli* Shasky, 1971
(Figure 21)

Kurtziella (*Rubellatoma*) *powelli* Shasky, The Veliger 14(1): 70-71, fig. 7 (July 1, 1971).

Material studied:
- Puerto Pizarro, Tumbes, Perú, one dead specimen, immature, 30-32 m, coarse sand; 3.1 x 1.3 mm (Figure 21) (VMA). February 5, 2010.

Published distribution: Head of the Golfo de California to Peninsula Santa Elena, Ecuador (McLean *in* Keen, 1971).

New locality: Puerto Pizarro, Tumbes Dept, Perú, in 30-32 m

Genus *Glyptaesopus* Pilsbry & Olsson, 1941

***Glyptaesopus phylira* (Dall, 1919)**
(Figure 22)

Philbertia (Nannodiella) phylira Dall, Proceedings of the United States National Museum 56 (2288): 60-61, pl. 20, fig. 6 (for 1920).
Synonym: *Philbertia amyela* Dall, 1919.

Material studied:
- Punta Malpelo, Tumbes, Perú, two immature specimens, 30 m, mud and sand; 3.1 x 1.2 and 3.2 x 1.3 mm (VMA). June 2, 2002.
- Caleta Máncora, Piura, Perú, one live specimen, 10-12 m, mud and sand; 7.1 x 2.0 mm (CS). August 05, 2004.
- Caleta La Cruz, Tumbes, one immature specimen, 10 m, mud and sand; 3.7 x 1.4 mm (VMA). June 6, 2002.
- Caleta La Cruz, Tumbes, one specimen, 30 m, mud; 4.6 x 1.5 mm (VMA). May 26, 2005.
- Puerto Pizarro, Tumbes, one live specimen, 30-32 m, coarse sand; 4.2 x 1.3 mm (Figure 22) (VMA). February 5, 2010.
- Puerto Pizarro, Tumbes one dead specimen, 30-32 m, coarse sand; 4.1 x 1.3 mm (VMA). June 8, 2010.

Published distribution: Bahía Concepción, Golfo de California, to Bahía San Francisco, Ecuador, at low tide and to 20 m (McLean *in* Keen, 1971).

New localities: Caleta Máncora, Piura, and Puerto Zorritos, Caleta La Cruz, Punta Malpelo, and Puerto Pizarro, Tumbes, Perú, in 10-32 m.

Genus *Platycythara* Woodring, 1928

***Platycythara electra* (Dall, 1919)**
(Figure 23)

Cytharella electra Dall, Proceedings of the United States National Museum 56 (2288): 77 (for 1920).

Material studied:
- El Bendito, off the mouth of the Río Zarumilla, near Puerto Pizarro, Tumbes, Perú, one specimen, 7-10 m, mud and mangrove detritus; (Figure 23) (CS). May 18, 2006.

Published distribution: Guaymas, Sonora, M xico, to Bahía Panamá, 20 to 70 m (McLean *in* Keen, 1971); Manabí Province, Ecuador (Shasky, 1984).

New locality: El Bendito, near Puerto Pizarro, Tumbes, Perú, in 7-10 m.

Figures 1-13. (1) *Polystira nobilis* (Hinds, 1843), 81.5 x 25.1 mm, dead, shrimp trawled, Puerto Pizarro, Tumbes, 20-25 m, coarse sand, January 18, 2007 (CST). **(2)** *Drillia (D.) roseola* (Hertlein & Strong, 1955), 23.1 x 9.5 mm, live, Caleta Máncora, Piura, 15-20 m, mud and sand, August 7, 2003 (CS). **(3)** *Crassispira (D.) erigone* (Dall, 1919), 21.5 x 8.9 mm, dead, shrimp trawled, Puerto Pizarro, Tumbes, 20-25 m, mud and sand, January 18, 2007 (CS). **(4)** *Crassispira (S.) adana* (Bartsch, 1950), 18 x 6.5 mm, live, Punta Malpelo, Tumbes, 20-30 m, mud and sand, May 17, 2006 (CS). **(5)** *Crassispira (S.) coracina* McLean & Poorman, 1971, 17.9 x 7.2 mm, live, Puerto Pizarro, Tumbes, 15-20 m, mud, January 20, 2004 (CS). **(6)** *Crassispira (S.) nigerrima* (Sowerby, 1834), 22 x 8.5 mm, live, Islilla Hueso de Ballena, Puerto Pizarro, Tumbes, 7-10 m, mud and mangrove detritus, June 6, 2002 (CS). **(7)** *Miraclathurella mendozana* Shasky, 1971, 13.9 x 4.9 mm, dead, Caleta La Cruz, Tumbes, 40-50 m, mud, May 20, 2005 (CS). **(8)** *Carinodrillia halis* (Dall, 1919), 20 x 6 mm, dead, Puerto Pizarro, Tumbes, 32 m, coarse sand and gravel, July 30, 2008 (CS). **(9)** *Compsodrillia alcestis* (Dall, 1919), 24.8 x 8 mm, dead, Puerto Pizarro, Tumbes, 20 m, mud and mangrove detritus, May 9, 2003 (CS). **(10)** *Compsodrillia bicarinata* (Shasky, 1961), 28.2 x 9.3 mm, dead, Puerto Pizarro, Tumbes, 20 m, mud and mangrove detritus, January 18, 2007 (CS). **(11)** *Compsodrillia undatichorda* McLean & Poorman, 1971, 11.8 x 4.5 mm, dead, Isla Lobos de Tierra, Lambayeque, 20-25 m, sand, April 21, 2002 (VMA). **(12)** *Compsodrillia* sp., 18.9 x 5.8 mm, live, Caleta Máncora, Piura, 180-200 m, October 26, 2004 (CS) **(13)** *Microdrillia tersa* Woodring, 1928, 10.1 x 3.2 mm, live, El Bendito, near the mouth of Río Zarumilla, Tumbes, 7-10 m, mud and mangrove detritus, May 18, 2006 (VMA). Figure 2 by Roberto Zamora de Brito; remaining figures by Valentín Mogollón Avila.


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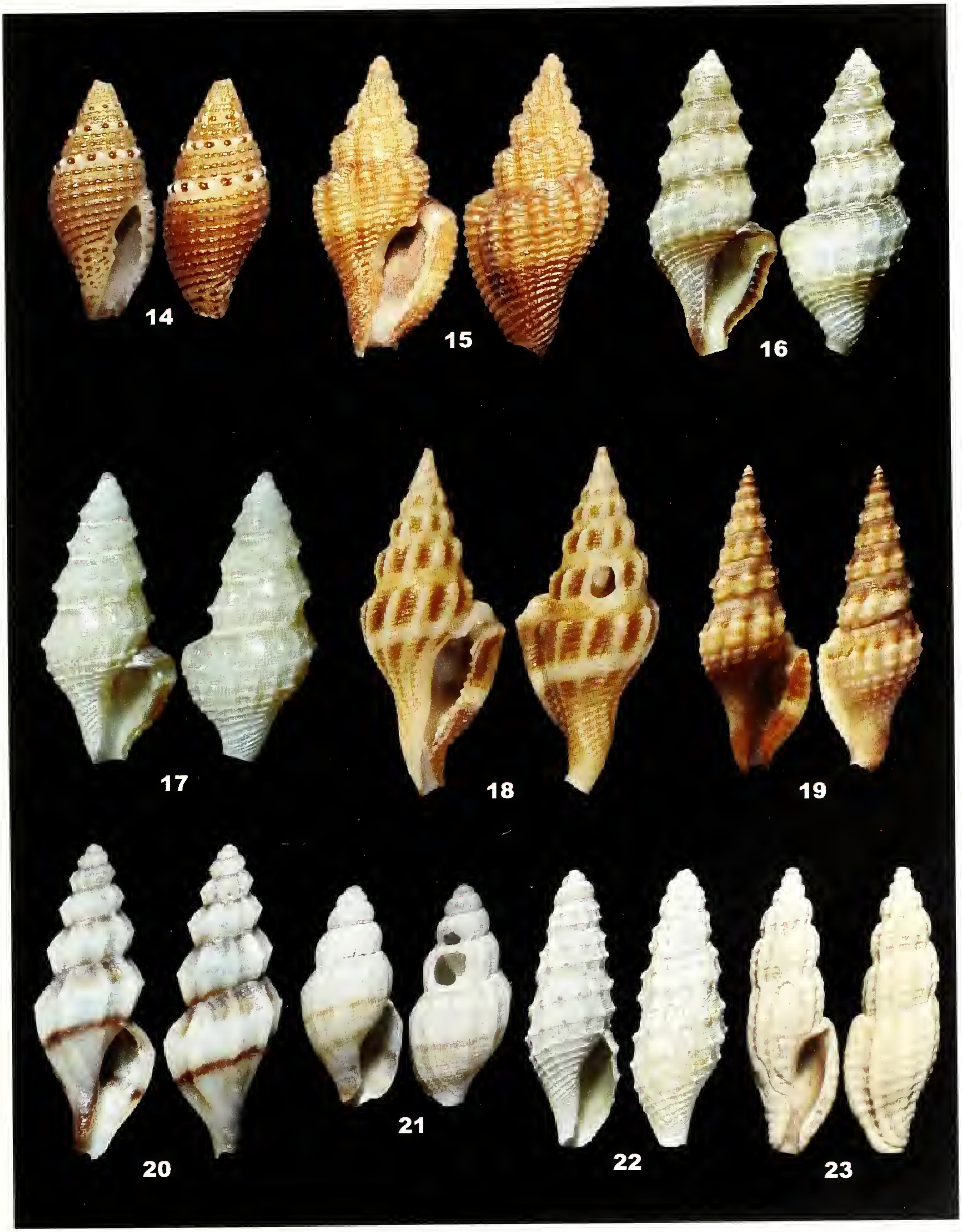
Figures 14-23. (14) *Cymakra* sp., 6.4 x 3.1 mm, live, Caleta Máncora, Piura, 180-200 m, attached to an old trawl net, tangled in a crab trap, October 26, 2004 (CS). **(15)** *Clathurella* sp., 10.3 x 5.0 mm, live, Caleta Máncora, Piura, 180-200 m depth, attached to a old trawl net, tangled in a crab trap, October 26, 2004 (CS). **(16)** *Nannodiella fraternalis* (Dall, 1919), 4.2 x 1.7 mm, live, Puerto Pizarro, Tumbes, 30-32 m, on coarse sand and ground shells, April 7, 2009 (VMA). **(17)** *Nannodiella nana* (Dall, 1919), 3.0 x 1.3 mm, live, Puerto Pizarro, Tumbes, 30-32 m, coarse sand and ground shells, February 11, 2009 (VMA). **(18)** *Glyphostoma* (*G.*) *bayeri* Olsson, 1971, 20.8 x 8.6 mm, dead, Puerto Pizarro, Tumbes, 30-32 m depth, coarse sand and gravel, February 5, 2010 (VMA). **(19)** *Glyphostoma* (*G.*) *neglecta* (Hinds, 1843), 12.5 x 4.5 mm, live, Puerto Pizarro, Tumbes, 30-32 m, coarse sand, February 11, 2009 (VMA). **(20)** *Kurtziella* (*K.*) *antiochroa* (Pilsbry & Lowe, 1932), 7.7 x 2.8 mm, live, Puerto Zorritos, Tumbes, 20-30 m, mud, February 4, 2007 (VMA). **(21)** *Kurtziella* (*R.*) *powelli* Shasky, 1971, 3.1 x 1.3 mm, dead, immature, Puerto Pizarro, Tumbes, 30-32 m, coarse sand, February 5, 2010 (VMA). **(22)** *Glyptaesopus phylira* (Dall, 1919), 4.2 x 1.3 mm, live, Puerto Pizarro, Tumbes, Perú, 30-32 m, coarse sand, February 5, 2010 (VMA). **(23)** *Platycythara electra* (Dall, 1919), live, El Bendito, off the mouth of the Río Zarumilla, near Puerto Pizarro, Tumbes, 7-10 m, mud and mangrove detritus, May 18, 2006 (CS).
All figures by Valentín Mogollón Avila.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MINUS TIDES IN SAN DIEGO FOR REMAINDER OF 2011

Date	Tide	Time	Date	Tide	Time
1 Jan	-1.1	Sat 1:46 pm	27 Sep	-0.4	Tue 3:48 pm
2 Jan	-1.3	Sun 2:25 pm	28 Sep	-0.6	Wed 4:36 pm
3 Jan	-1.3	Mon 3:00 pm	29 Sep	-0.6	Thu 5:28 pm
18 Jan	-1.5	Tue 2:36 pm	26 Oct	-1.1	Wed 3:40 pm
19 Jan	-1.6	Wed 3:12 pm	27 Oct	-1.3	Thr 4:28 pm
16 Feb	-1.4	Wed 2:10 pm	28 Oct	-1.2	Fri 5:20 pm
17 Feb	-1.5	Thr 2:43 pm	12 Nov	-0.2	Sat 4:00 pm
18 Feb	-1.3	Fri 3:17 pm	25 Nov	-1.7	Fri 3:22 pm
19 Feb	-0.9	Sat 3:52 pm	26 Nov	-1.5	Sat 4:10 pm
17 Mar	-0.9	Thr 2:34 pm	8 Dec	-0.4	Thr 2:15 pm
18 Mar	-0.9	Fri 3:09 pm	9 Dec	-0.6	Fri 2:47 pm
19 Mar	-0.6	Sat 3:49 pm	10 Dec	-0.7	Sat 3:20 pm
20 Mar	-0.2	Sun 4:18 pm	22 Dec	-1.4	Thr 1:48 pm
21 May	-0.6	Sat 7:14 am	23 Dec	-1.7	Fri 2:32 pm
22 May	-0.1	Sun 8:10 am	24 Dec	-1.6	Sat 3:56 pm

Paul Tuskes

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THE FESTIVUS

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Meeting date: third Thursday, 7:30 PM, Room 104, Casa Del Prado, Balboa Park, San Diego

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PROGRAM

Plugging the Holes in Abalone and Scissurellid Systematics: Preview of Two Monographs for 2011 and 2012

Daniel Geiger, of the Santa Barbara Museum of Natural History, a specialist in the fascinating scissurellids and haliotids will present an illustrated program highlighting work in these groups that will be soon be published.

Meeting date: March 17, 2011

CONTENTS

Club news 28

The zonation and density of the macromolluscs living in the mangrove swamps of the sand barrier of El Mogote, La Paz, Baja California Sur, México
ESTEBAN FERNANDO FÉLIX-PICO[1], MARTÍN E. HERNÁNDEZ-RIVAS[1], OSCAR EFRAÍN HOLGUÍN-QUIÑONES[1] & GERARDO VARGAS-LÓPEZ[2] 29

Book review: *Encyclopedia of Texas Seashells, Identification, Ecology, Distribution & History*
HENRY CHANEY, reviewer 35

In Memoriam: William T. Schneider
CAROLE M. HERTZ 36

CLUB NEWS

San Diego Shell Club Meeting Minutes
February 17, 2011

In the absence of President Jules Hertz, the meeting was called to order at 8:00 P.M. by Vice President Bob Dees. He said that we were experiencing difficulties with the connection between the computer and the projector and so the program was cancelled. Hans Bertsch was invited to speak at a future meeting.

Silvana Vollero reported as treasurer that the Club continued to be financially solvent. Marilyn Goldammer encouraged members to use the wonderful resources in our library. Wes Farmer reminded members that the Botanical Garden Foundation expects all groups using the room to remove their trash, return chairs and tables to their normal places and to maintain a generally clean room.

George Kennedy read a thank you letter from WSM to our Club thanking us for the donation to their student grant fund. Marilyn informed the members of the recent passing of our friend Bill Schneider. One guest was present -- Joanne is a friend of Wes. She mentioned that she paints and draws shells, but had not heard of our Club until recently.

Hans introduced his topic and briefly spoke about the "blue shells (abalone)." A Jesuit by the name of Kino who lived in the 1700s was an interesting man who mapped California, not as an island, but as a peninsula, contrary to the opinion of the times. Hans said he would be happy to reschedule and give his entire program on a future date.

The winner of the door prize was Hans Bertsch, the good sport of the evening. Thank you to Marty Schuler and Marilyn Goldammer for the delicious refreshments for the evening. The meeting was adjourned at 8:15 P.M

Silvana Vollero
(taking minutes in the absence of Paul Tuskes, Recording Secretary)

Too Late for the Roster

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Come to the Auction/Potluck – 2011
Saturday, April 16th

Saturday April 16th is the big date!! Festivities will begin at 5 PM for "Dave's Punch" [plus wine and soft drinks], visiting with friends, and viewing the voice auction and silent auction material. By 6 PM sharp we will enjoy the potluck delicacies provided by our members. And at 7 PM promptly the voice auction will begin– the excitement of the evening! Halfway through the evening, the $1 table will be opened to much enthusiasm. A whole ping-pong table loaded with shells for only one dollar each is a joy that cannot be denied.

As it has been for the last 23 years, Wes Farmer will again host this event at the clubhouse of his condo. The address is 3591 Ruffin Road, San Diego, CA 92123. If you need a map, contact Carole & Jules Hertz at: jhertz@san.rr.com or call at 858-277-6259.

For the potluck, please bring a dish to serve 12. Club members really like to eat! Bring either a salad, main dish or dessert – with serving utensils please. The sign-up list for the potluck contributions will be passed at the March meeting. Contact Carole and Jules if you are unable to attend the March meeting and want to sign up for the potluck.

If you are unable to attend the auction and would like to bid on any item[s], a Club member disinterested in your choice will bid for you following your instructions.

This is the Club's only fundraiser and biggest social event of the year. Your help is needed to make it a success. The auction provides the Club with the funds necessary to help support its activities – *The Festivus*, donations to student grants and other scientific efforts and allows the Club to keep its dues very low. Donations to the auction are welcomed. If received late, they may be held for the auction the following year. Your donations are always greatly appreciated.

Looking forward to seeing you all at the Auction/Potluck – 2011!!

THE ZONATION AND DENSITY OF THE MACROMOLLUSCS LIVING IN THE MANGROVE SWAMPS OF THE SAND BARRIER OF EL MOGOTE, LA PAZ, BAJA CALIFORNIA SUR, MÉXICO

ESTEBAN FERNANDO FÉLIX-PICO[1], MARTÍN E. HERNÁNDEZ-RIVAS[1], OSCAR EFRAÍN HOLGUÍN-QUIÑONES[1] AND VÍCTOR GERARDO VARGAS-LÓPEZ[2]

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ABSTRACT
On the eastern coast of Baja California Sur, a qualitative and quantitative seasonal study of the faunal community associated with the submerged roots of the red mangrove was taken by sampling 5 roots from different areas and preserving them with 10% formaldehyde. Three representative sampling areas were chosen in the inland and border areas of the mangrove with the total area estimated as 200 ha. The monthly sampling was done during August 2007 to July 2008. The Shannon-Wiener Index was used to analyze diversity and evenness of value for these areas. The results showed 12 species of macromolluscs with the dominant species *Saccostrea palmula* and *Anadara tuberculosa*. Further results show the effects of human activity and natural occurrences on the diversity of the areas, thus helping to develop strategies to carefully manage and protect the mangroves.

Key words: Bivalvia, *Anadara*, *Saccostrea*, red mangrove, diversity indexes.

Introduction

The marine invertebrate assemblage of Ensenada de La Paz – El Mogote, on the southeastern coast of the Baja California Peninsula, consists primarily of a tropically derived fauna. This is well exemplified by the local mollusc-associated fauna with mangrove swamps. The mangrove forests are found in isolated strips, bush-like, with limited coverage and estimated as a total area of 200 ha fringing the lagoon of La Paz. The study area covered by eight patches of mangrove (0.25 to 45) was 108.9 ha (Holguín et. al., 2005). This region is considered one of the most arid locations in the country, with very little permanent flowing surface water due to small amounts of rainfall. Mean annual precipitation is 184.8 mm (Félix-Pico et. al., 2006). A qualitative and quantitative seasonal study of the faunal community associated with the submerged roots of the red mangrove (*Rhizophora mangle*) was undertaken.

The diversity in the mangrove swamp forests offer the possibility of colonization to a great number of species of macroinvertebrates. For many ecologists the mangrove community creates unique ecological environments that host rich assemblages of species, since it is a feeding zone and plays a special role as nursery and in reproduction of many invertebrates. The inventory of species is still being integrated, and most of the phyla are represented by species that are not described because some are cryptic groups. In the Golfo de California the compilations by diverse authors reached a total of 213 species: 72 crustaceans, 62 bivalves, 36 gastropods, 14 polychaetes, 5 anemones, 5 sponges, 5 echinoderms, 3 polyplacophores, 4 chordates, and 3 bryozoans and sipunculans. However, there is a great number of species of macroinvertebrates that appear occasionally in the mangrove swamps, although they are usually found in other types of habitat (Whitmore et al., 2005).

Only a few species represent great economic interest, such as the bivalve filter feeders *Anadara tuberculosa* (Sowerby, 1833) and *Saccostrea palmula* (Carpenter, 1857) which are some of the most important components in these mangrove forests. Unfortunately they have been poorly studied. This community plays an

important role in the life of many species of commercial interest.

Methods and Materials

The samplings were done monthly from August 2007 to July 2008, covering three swamps or esteros within the sand barrier of the Ensenada de La Paz lagoon; three representative sampling areas on El Mogote (24°08'80" N, 110°8'23" W) (Figure 1). Each sampling collected 5 roots of the red mangrove with their separate organisms of oysters and other sessile organisms attached to the prop roots. The material was preserved with a 10% formaldehyde solution. To determine the species we used Keen (1971), Abbott (1974), Brusca (1980), Coan et al. (2000), and Kerstitch & Bertsch (2007).

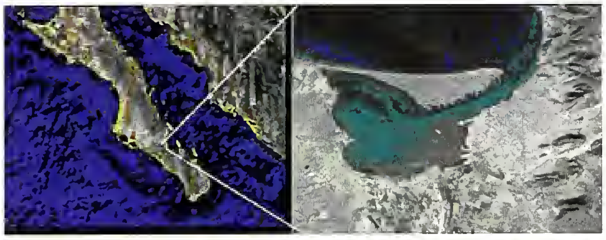

Figure 1. Mangrove areas shown in red and green for the sampling sites in the Ensenada de la Paz– El Mogote sand barrier.

The method to determine infauna density consisted of collecting by line transect during a period of approximately 45 min. The sampling took place on a transect of 40 m in length within the mangrove swamp, by looking between the mud and roots (English et al., 1997). The minimum sample size was 30 clams for biometric analysis (Figure 2).

We expressed the molluscan species richness (S) as number of taxa, and calculated Shannon's (H) and Berger-Parker´s diversity index, (E) equitability and (R) redundancy (Pielou, 1975) (Table 3).

Discussion

The composition of macroinvertebrates was 43 species; this community associated with the mangrove swamp is formed by a few common species with a high density population but a great majority of rare species with low density. By taxon, the crustaceans were represented by barnacles with *Chthamalus fissus* as dominant with a high number of individuals but not by biomass as the oyster *Saccostrea palmula*, while the infauna with

Figure 2. Community associated to the root and cleaning process

Anadara tuberculosa represented the dominant species in density and biomass.

The species of macroinvertebrates noted in the mangrove swamps of lagoons, coves, matting, and in the islands of the Golfo de California is very diverse (Whitmore et al., 2005). The majority of the species occupy the intertidal zone while others permanently live in the channels and lagoons of the mangrove swamps (Holguín Quiñones et al., 2000). This contrasts with the African coasts with more than 48 species of bivalves, the west American coast with 11 species, the North American southeastern coast with 10 species, and the Caribbean (Reyes & Campos, 1992) and northeastern coast of South America with 37 species of bivalves (Morton, 1983). In the Cuban mangrove swamps Lalana (1986) reported 14 bivalves and 17 gastropods, and at the Golfo de Santa Fé, Venezuela, 15 bivalves and 22 gastropod species were found (Sutherland, 1980; Márquez & Jiménez, 2002).

Parker (1969) described the associated community of the mangrove swamp in the Golfo de California. He found the infauna dominated by species of the families Corbiculidae and Arcidae, and attached to the roots the families Ostreidae and Mytilidae. Whitmore et al. (2005) listed a total of 213 species, 72 crustaceans, 62 bivalves, 36 gastropods, 14 polychaetes, 5 anemones, 5 sponges, 5 echinoderms, 3 polyplacophorans, 4 chordates and 3 bryozoans and sipunculans. However, there is a great number of species of macroinvertebrates that appear occasionally in the mangrove swamps although they belong to another type of habitat

(Espinosa Garduño et al., 1982; Cruz & Jiménez, 1994). In this study there were 12 bivalve species and the molluscs found in this area represent 25% of the fauna reported by Whitmore et al. (2005). The bivalves were abundant, especially *Saccostrea palmula* on the roots and at the infauna by *Anadara tuberculosa*.

Results

The mangrove community composed of *Laguncularia racemosa* and *Rhizophora mangle* were the dominant species on the borders of the mangrove swamps, while *Avicennia germinans* dominated the inland areas (Figure 3). The highest values of density averaged 1,937 specimens ha^{-1}, with an average height of 2.4 m and

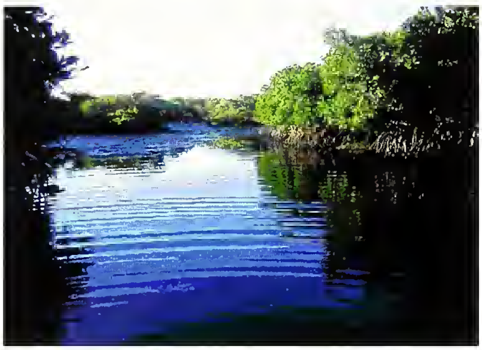

Figure 3. Red mangroves community of the channel of Estero B.

basal area of 5.48 m^{-2} ha^{-1}. The mangroves have a complexity index averaging 0.19 > 10cm (DBH).

The species richness was composed of 43 macroinvertebrates from 7 phyla found throughout the year in the mangrove swamps (Figure 4). The epifauna attached to prop roots of the red mangroves was composed of 17 crustaceans, 8 molluscs, 2 echinoderms, 2 polychaetes, 2 anemones, 1 platyhelminthes and 1 sipunculan. The infauna was composed of 4 crustaceans, 4 molluscs, 1 echinoderm and 1 polychaete.

The species diversity in the three esteros was related to season. There were two peaks in diversity during summer (July) and winter (February). Low diversity was observed in autumn (December) and spring (March) (Figure 5). The diversity was moderate in late spring and early autumn when the temperature was stable at 24°C, but in winter and summer the temperature was highly variable (19 to 32°C). Also, salinity is highly variable in autumn and spring (36 to 42 ups.).

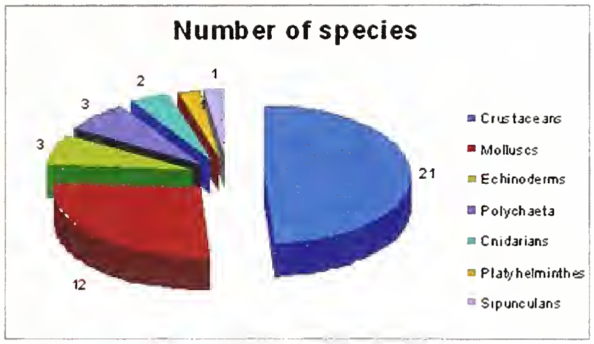

Figure 4. Pie chart showing the distribution of the 7 phyla found throughout the year in the mangrove swamps.

Therefore, species richness was relatively low, while diversity indices were high in winter.

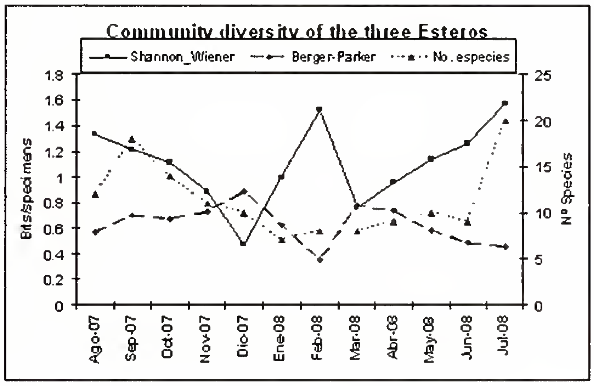

Figure 5. Monthly distribution of the number of species of dominant macroinvertebrate taxa and the diversity indices (Shannon-Wiener & Berger Parker) in the three esteros of the El Mogote sand barrier.

Among the macroinvertebrates, the highest diversity in the southern Golfo de California occurs with the Mollusca (1,386 taxa) (Figure 6) and the Arthropoda with 785 taxa (Brusca et al., 2005). Within the mangroves, the bivalves and gastropods stand out with 7 and 5 taxa respectively (Table 1). The most abundant species are *Saccostrea palmula* (47.1%), *Anadara tuberculosa* (41.4%), *Brachidontes semilaevis* (4.2%), *Cumingia adamsi* (2.8%), *Nerita funiculata* (1.6%) and *Lithophaga aristata* (1.4%) (Table 2). There were no significant differences between diversity (H), equity (E) and richness of the species (S) during the months and site of the study (Table 3).

Figure 6. Species of bivalves and gastropods associated wtth the root-oyster *Crassostrea palmula*, *Corbula inflata*, *Anadara tuberculosa*, *Cerithidia valida* and *Aplysia californica*.

Acknowledgments

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Table 1. Taxonomic classification of macromollusc species associated with the mangrove swamp

CLASS	FAMILY	SPECIES	COMMON NAME
Bivalvia	Arcidae	*Anadara tuberculosa* (Sowerby, 1833)	Black or Blood ark
	Corbulidae	*Corbula inflata* (C.B. Adams, 1852)	Mud clam
	Isognomidae	*Isognomon janus* (Carpenter, 1857)	Tree oyster
	Mytilidae	*Brachidontes semilaevis* (Menke, 1849)	Mussel
		Lithophaga aristata (Dillwyn, 1817)	Bore mussel
	Ostreidae	*Crassostrea palmula* (Carpenter, 1857)	Palmate oyster
	Semelidae	*Cumingia adamsi* Olsson, 1961	Clam
Gastropoda	Aplysiidae	*Aplysia californica* Cooper, 1865	California sea hare
	Calyptraeidae	*Crepidula onyx* Sowerby, 1824	Onyx slipper
	Cerithiidae	*Cerithium stercusmuscarum* Valenciennes, 1833	Pacific-specked cerith
	Neritidae	*Nerita scabricosta* Lamarck, 1822	Rough-ribbed nerite
	Potamididae	*Cerithidea valida* (C.B. Adams, 1852)	Varicose horn shell

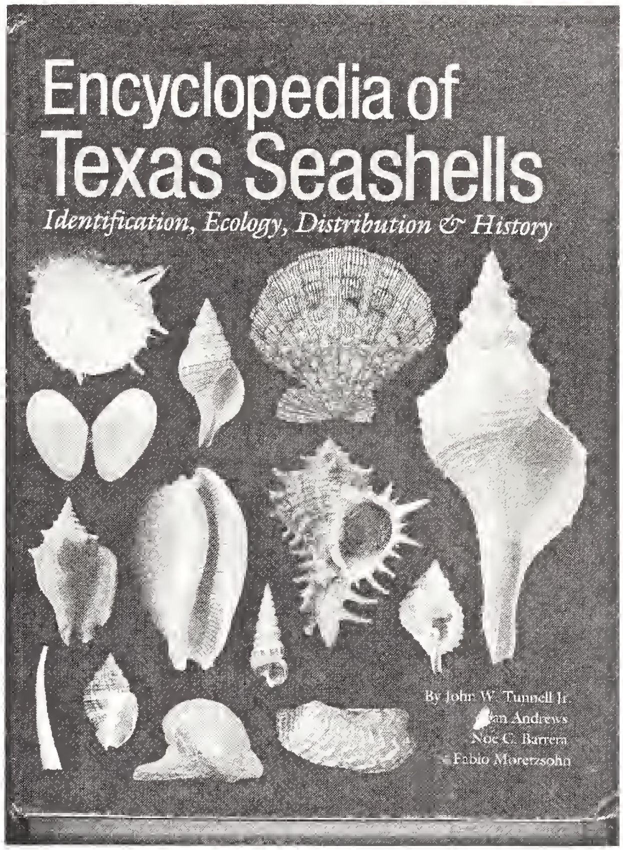
Table 2. Dominance index of macromollusc species associated with the selected three mangrove swamps

SPECIES	DOMINANCE INDEX	CUMULATIVE
Crassostrea palmula	47.073	47.073
Anadara tuberculosa	41.413	88.486
Brachidontes semilaevis	4.209	92.695
Cumingia adamsi	2.854	95.549
Nerita funiculata	1.572	97.121
Lithophaga aristata	1.451	98.573
Cerithium stercusmuscarum	0.726	99.299
Isognomon janus	0.339	99.637
Crepidula onyx	0.169	99.806
Corbula inflata	0.097	99.903
Cerithidea valida	0.073	99.976
Aplysia californica	0.024	100.000
	100.000	

Table 3. Abundance, diversity of Shannon-Wiener & Berger Parker indices of macromollusc species associated with the mangrove swamps

LOCATION	ABUNDANCE	S	H '	E	R
Estero A	1781	9.0	0.477	0.458	0.535
Estero B	1332	10.4	0.410	0.485	0.290
Estero C	1021	12.0	0.491	0.515	0.338
Total	4134	31.4	1.378	1.458	1.163

Encyclopedia of Texas Seashells, Identification, Ecology, Distribution & History
By: John W. Tunnell, Jr., Jean Andrews, Noe C. Barrera & Fabio Moretzohn. 2010.
Texas A&M University Press, College Station, Texas
512 pages. List price at $50.00



For more than a generation, those studying the mollusks of the Texas coastline have had limited choices when it came to popular references. Since its initial publication in 1971, the *Sea Shells of the Texas Coast* as well as its subsequent edition or abridged field guides, all authored by Jean Andrews, was the primary identification source for collectors, who may not have had access to the more diffuse technical literature. Well produced for its era, with a format that resembled that used by Tucker Abbott during the same time, the 1971 survey was limited in its coverage to the larger species with single b/w halftone figures [color figures coming later in the field guide versions].

These limitations have now been swept aside by the production of *Encyclopedia of Texas Seashells*, the result of many years of collaborative work, not only by the four primary authors, which include the late Jean Andrews, but by their students, amateur and expert collectors, ecologists and geologists. The result is a magnificent 512 page, profusely illustrated and referenced tome that will now take its place as the definitive popular guide for the shells of the northern Gulf of Mexico.

This work will function as comprehensive identification reference, containing more than 900 species in systematic arrangement, including the micro-mollusks (with very well executed optical images) and deep-water taxa that are now just becoming better known. Each species is presented in a standard format that includes, scientific and common nomenclature, distribution and size information, a concise description of the shell, its habitat, followed by specific remarks. Most species are figured both dorsally and ventrally in a clear 4-6 square inch color balanced image. Keeping with its more popular usage, only the most widely known synonyms are listed, but there are specific citations to the extensive bibliography for further reference. All in all a very well-presented guide that is both easy to use and easy on the eye.

But there is more. The species accounts are in Chapter Six of the "Encyclopedia" and while that takes up about two thirds of the book, the previous sections in the first 100 pages are accounts on coastal geology, the collection traditions of Texan malacology, a remarkably good chapter on the ecology and habitats of mollusks, followed by accounts on collecting methodologies and a very good, concise account on mollusk morphologies, in which the illustrations alone would be of use to any collector anywhere, particularly when used in combination to the extensive glossary also included.

Clearly a very positive contribution to the mollusk literature, this work takes its place now as one of the primary resources for North American collectors, with sections that will be of use to a wider audience. An added advantage, in this era of the expensive color shell atlases, is that this work had a large press run and is very modestly priced. Look online for the best deal. Also, as with any book of this size there are errors or addenda that are being noted. These will undoubtedly be available, so again check online or contact the authors for updates.

Henry Chaney

Editor's note: This book will be in the Club library by the March meeting.

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IN MEMORIAM

WILLIAM T. SCHNEIDER
May 6,1930 - February 8, 2011

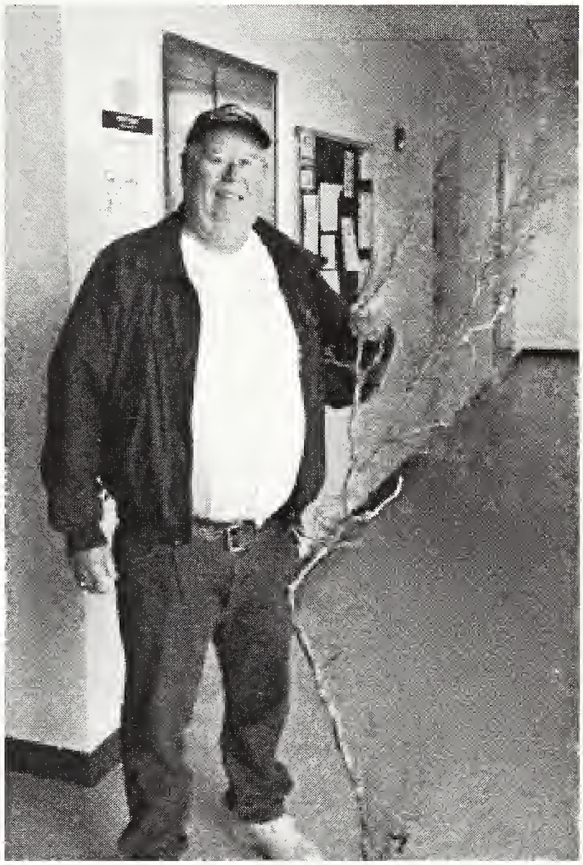
It is with much sadness that we report the passing of our friend Bill Schneider. Bill, a native San Diegan has been an active San Diego Shell Club member, along with his wife Nancy, since 1992 and president of the Club in 2006.

Bill and Nancy became interested in rocks and minerals and started their business, *Schneider's Rocks and Minerals*, in Poway in 1960. Bill was also a dealer at regional Gem and Mineral Shows for many years. Then, in the early 1980s Bill and Nancy began traveling to Baja and became fascinated with fossil and Recent shells and their private shell collection was started. They even bought a vacation home in Mulegé. During the years of visiting Baja, they became involved with the small museum there and being very generous people, donated several beautiful showcases with their fossil and Recent shells to that museum, even transporting the exhibit down there and setting it up themselves.

On retirement, Bill became an avid deep-water sport fisherman, often taking off with his son Tom for some wonderful far-away place such as Hurricane Bank (1000 miles south of San Diego and 600 miles west of México), or Clipperton (see Schneider, 2004), or other slightly closer areas. He was always on the lookout for the "BIG fish" over 200 pounds.

During one of his deep-sea trips to Hurricane Bank, the ship "caught," at 128 meters, a large piece of black coral over six feet high entangled in the net. Bill brought it to the surface and "recognized it as the largest specimen of black coral that I had ever seen." He was the only one on board who realized the lapidary interest in this coral. He also looked it over and found some molluscan critters on the coral and brought it to the attention of others to be identified (Schneider, 2006). Bill donated the black coral "tree" (*Myriopathes ulex*, to the Benthic Invertebrate Collection at Scripps Institution of Oceanography where it is stored with other self-collected marine specimens he donated in the SIO collections.

In fact, Bill became very active in Scripps. At the time that he learned that the world class marine collections of Scripps were in danger of being sent to other institutions as a result of lack of funding, he worked hard for their funding and became a valuable addition to the Scripps' Collections Taskforce.



Bill with his over six foot high coral tree. Reprinted from Bill's article in the *The Festivus* in 2006.

Bill Schneider had a love of life and an appreciation of the beauty of the natural world. We will all miss his friendship. He is survived by his wife Nancy, children Jeannie Hume, Tom Schneider, Kelly Ann Schneider, Caroline Lepore and five grandchildren.

Publications by Bill Schneider in *The Festivus*
2004. A fisherman explores Clipperton Island. 36(4): 37-40, figs. 1-3.
2006. Collecting *Rhizochilus antipathum* by hook & line. 28(3): 27-31, figs.1-10.

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THE FESTIVUS

A publication of the San Diego Shell Club

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Meeting date: third Thursday, 7:30 PM,
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PROGRAM

Come to the Auction – Saturday April 16th.
There will be no regular meeting this month.

CONTENTS

Club news 38
Species list of opisthobranch mollusks for Bahía de Banderas (Jalisco-Nayarit), Pacific coast of México
ALICIA HERMOSILLO-GONZÁLEZ 39

CLUB NEWS

San Diego Shell Club Meeting Minutes
17 March 2011

The meeting was called to order at 7:35 P.M. by Jules Hertz, President. The previous minutes were accepted as published. Marilyn Goldammer, librarian/secretary, reminded us that a new book *The Encyclopedia of Texas Sea Shells* is now in the library. Silvana Vollero gave the treasurer's report and all is well. Jules mentioned we are looking for a location for the September summer party. Please contact Jules or Carole at 858-277-6259 if you are able to host this annual event.

Carole Hertz reviewed the arrangements for the April auction and asked that each person who signed up bring food to serve 12 people. If you have not signed up, please call Carole directly to tell her what you are bringing. Please keep Saturday April 16th open as that is the day of the annual shell auction.

Shell club members will again be judging the Greater San Diego Science and Engineering Fair on March 23rd. This year the Judges will be David Waller, John LaGrange, and Ann and Paul Tuskes.

Bob Dees introduced our speaker for March, Dr. Daniel Geiger from the Santa Barbara Museum of Natural History. His topic was *Plugging the Holes in Abalone and Scissurellid Systematics*. The term Archaeogastropoda is falling out of use and being superseded by Vetigastropoda. Vetigastropods include little slit shells, large slit shells, abalone, keyhole limpets, top shells, and others. His presentation focused on the small slit shells, *Scissurella*. These shells typically measure from 1-5 mm and are found worldwide especially in tropical and temperate seas. As a result of their small size, work on dissecting and illustrating their radula is tedious but within some groups of *scissurellids* are an important taxonomic factor along with the characteristics of the protoconch and shell morphology. His excellent photos from the scanning electron microscope documented the fine, ornate structure of the shells. During his study, he has examined tens of thousands of specimens from collections around the world and expects to publish this work in 2012. He recently completed a study of the abalone of the world, which will be available later this year. We had the opportunity to see some of the plates, and observed that many individuals were illustrated in order to document the range of shell variation. It was an exciting program.

The winner of the door prize was Daniel Petrosky The meeting was adjourned at 9:00 P.M. and the members and guests enjoyed the refreshments provided by Wes Farmer, Carole & Jules Hertz and Marty Schuler.

Paul Tuskes

Too Late for the Roster

KENNEDY, GEORGE, 8997 Moisan Way, La Mesa, CA 91941. Phone: 619-667-1030. E-mail: gkennedy@bfsa-ca.com

UNAM 34316 PB3, Teldan Inc., P.O. Box 3618, Bala Cynwyd, PA 19004.

44th Annual Meeting of the Western Society of Malacologists & 12th Biannual Meeting of the Sociedad Mexicana de Malacología

This is the announcement of the combined joint meeting of the two above-named organizations which will take place in La Paz, California Sur, México from June 27-30, 2011, hosted by the Instituto Politécnico Nacional, Centro Interdisciplinario de Ciencias Marinas.

The conference hotel is the Hotel Perla with meetings and exhibitions at the Convention Center Madre Perla Hotel Perla and Centro Cultural La Paz.

For questions concerning payments only, contact WSM treasurer Kevin Barwick at kbarwick@ocsd.com. For further information on the meeting, contact either Esteban Felix Pico at efelix@ipn.mx or Hans Bertsch at hansmrvida@sbcglobal.net

Come to the Auction/Potluck – 2011
Saturday, April 16th

Don't forget – Saturday April 16th is the big date!! Festivities will begin at 5 PM. By 6 PM sharp we will enjoy the potluck delicacies and at 7 PM promptly the voice auction will begin– the excitement of the evening! Looking forward to seeing you all at the Auction/Potluck – 2011!!

SPECIES LIST OF OPISTHOBRANCH MOLLUSKS FOR BAHÍA DE BANDERAS (JALISCO-NAYARIT), PACIFIC COAST OF MÉXICO

ALICIA HERMOSILLO-GONZÁLEZ

Universidad de Guadalajara
Centro Universitario de Ciencias Biológicas y Agropecuarias
Las Agujas, Zapopan, Jalisco, México
E-mail: alicia_titan@infosel.net.mx

Abstract The opisthobranch fauna of Bahía de Banderas has been subject of intensive study from 2002 to date. A list of 146 species of Cephalaspidea, Anaspidea, Pleurobranchia, Sacoglossa and Nudibranchia is here reported, with a biogeographical affinities analysis. Bahía de Banderas presents a 67.1% Panamic affinity, with 5.5% species so far only reported for this area. Bahía de Banderas is the northernmost report for 17 species and the southernmost for 21. This represents the degree of diversity that would be expected for a transition zone.

Desde 2002 a la fecha, la fauna de opistobranquios de Bahía de Bandera ha sido sujeta de estudios intensivos. Una lista de 146 especies de Cephalaspidea, Anaspidea, Pleurobranchia, Sacoglossa y Nudibranchia se reportan en este artículo, junto con un análisis de las afinidades biogeográficas. Bahía de Banderas presenta una afinidad predominantemente Panámica (67.1%), con 5.5% de especies que hasta ahora solamente se han reportado en esta área de estudio. Bahía de Banderas es el reporte más al norte para 17 especies y más al sur para 21. Esto representa una gran diversidad que es de esperarse en un área que es zona de transición.

Introduction

Bahía de Banderas is located on the Pacific mainland of México, in the states of Jalisco and Nayarit. The opisthobranch fauna of Bahía de Banderas has been the subject of intensive studies during the past nine years. This paper summarizes the opisthobranch-related research in Bahía de Banderas, with updated literature, new species published and biogeographical affinities analysis of the species reported.

Hermosillo-González (2003) describes the physiographic and biological characteristics of Bahía de Banderas and a list of species, including range extensions for 20 species. Before that publication, there were only a few published reports on the opisthobranch fauna of the northern coast of the Bay, in Nayarit (Sphon, 1972; Bertsch et. al 1973, Bertsch 1978, 1980, Bertsch & Kerstitch, 1984, Ferreira & Bertsch, 1975) and Isla Isabel (Ortea & Llera, 1981). Conversely, there were no publications of the central and southern sections of the Bay, along the coast of Jalisco. In 2006, Hermosillo-González reported finding 30 undescribed species and 46 new distribution records, with a list of 140 different species, ecological observations, classification of taxonomic groups according to food sources, habitats and opisthobranch communities in Bahía de Banderas. In 2008, the CONACYT (Consejo Nacional de Ciencia y Tecnología) y Acuacultura y Ecosistemas Marinos del Centro Universitario de Ciencias Biológicas y Agropecuarias (Universidad de Guadalajara) funded the project "Ecology and conservation of the Opisthobranch mollusks of Bahía de Banderas, in México's central Pacific." This work resulted in two undergraduate theses. Ramírez-Cordero (2008) determined the maximum number of scuba divers that could visit two different localities (Islas Marietas and Los Arcos) considering the potential impact of their activities on the ecosystem. Alonzo-Dominguez (2009)

analysed the actual impact of scuba divers on the environment by counting the interactions (physical contact) of divers with different levels of experience.

Some species found in Bahía de Banderas have been described in recent years: Fahey & Gosliner, 2003 (*Hoplodoris bramale*); Angulo-Campillo & Valdés, 2003 (*Cuthona lizae*); Ortea, Caballer & Espinosa, 2003 (*Hermosita hakinamatata*); Gosliner & Bertsch, 2004 (*Okenia agelica*, *Okenia cochimi* and *Okenia mexicorum*); Dayrat, 2005 (*Discodoris aliciae*); Hermosillo & Valdés, 2004 (*Peltodoris lopezi* and *Trapania goddardi*); Camacho-García & Gosliner, 2006 (*Janolus annulatus*); Chan & Gosliner, 2006 (*Thordisa niesseni*); Hermosillo & Valdés, 2007 (*Cuthona millenae*, *Cerberilla chavezi* and *Eubranchus yolandae*); Millen & Hermosillo, 2007 (*Flabellina fogata*); Hermosillo & Valdés 2008a (*Polycera kaiserae*); Hermosillo & Valdés, 2008b (*Cuthona riosi* and *Berthella grovesi*) and Camacho-García & Gosliner, 2008 (*Jorunna tempisquensis*). More new species known from Bahía de Banderas are being currently described.

There are further publications with redescriptions and taxonomic revisions of families, genera and species as well as revised geographical distributions: Valdés (2003, 2004); Fahey & Gosliner (2004); Gosliner (2004); Valdés & Bouchet (2005) and Pola et al. (2006). This new knowledge applies to several species found in Bahía de Banderas.

Various authors have greatly contributed to the knowledge of the opisthobranch fauna of the tropical Eastern Pacific: Angulo-Campillo (2002 [new records for La Paz area, in Baja California Sur]); Behrens (2004 [supplement with synonyms of the species from Behrens 1991]); and Hermosillo & Behrens (2005 [with distribution records for the Pacific Coast of México]). Three books were published as illustrated field identification guides for opisthobranchs of the tropical Eastern Pacific: Camacho-García et al.(2005 [from Costa Rica to Ecuador, including the Islas Galápagos]); Behrens & Hermosillo, (2005 [from Alaska to Central America]) and Hermosillo et al. (2006 [from the Pacific coast of México]).

Bertsch (1973) reported that a large number of species of opisthobranchs known from the Panamic Province are common in the temperate or Californian Province. Back then, there was little knowledge of the opisthobranch fauna south of the México - United States border.

The knowledge has increased greatly in the past 37 years and the opisthobranch fauna of the Mexican Pacific is now relatively well known. Some species originally known from the Indo-Pacific have now been observed consistently in the Eastern Pacific: *Phestilla lugubris*, *Notarchus indicus*, *Umbraculum umbraculum* and *Elysia pusilla* to mention a few. Similarly, species from the Eastern Pacific have been recently found in the Caribbean: *Glossodoris sedna*, *Pleurobranchus aerolatus*, *Lomanotus vermiformis* and *Lobiger souverbii* (Valdés et al., 2006). Species known from the Oregonian or Californian Province have been gradually reported for the Mexican Pacific and Costa Rica (Camacho-García et al., 2006); at Panamá (Hermosillo, 2004; Hermosillo & Camacho-García, 2006) and Perú (Nakamura, 2006).

Materials and methods

From 2002 to 2005, ten localities in seven different sites within Bahía de Banderas were surveyed monthly by scuba and intertidal excursions. From 2005 to 2010, those same localities were visited constantly but with no statistical regularity. These localities as well as the survey methods are described in Hermosillo-González (2003 & 2006); Ramírez-Cordero (2008) and Alonso-Dominguez (2009).

Species list

Altogether 146 species have been reported: 5 Cephalaspidea, 6 Pleurobranchia, 15 Sacoglossa, 9 Anaspidea and 111 Nudibranchia (with 40 Aeolidina, 51 Doridina, 18 Dendronotina and two Arminina).

The expected number of different species in Bahía de Banderas can be estimated by plotting the cumulative number of species found during a certain period of time. Figure 1 shows this curve, where an approximate asymptote (limiting value of a curve) can be observed at 150 species. The 146 species so far found represent about 97% of the total expected.

In order to classify the biogeographical affinities of the opisthobranch fauna of Bahía de Banderas, the species were assigned different regions that correspond to their known geographical distribution according to the parameters established by Emerson (1978), Bertsch (1993) and Behrens & Hermosillo (2005). Each region represents distinct oceanographic characteristics due to the influence of the oceanic currents. The most important variable is the temperature pattern, which ultimately determines the geographical distribution and abundance

of marine organisms (Todd, 1981).

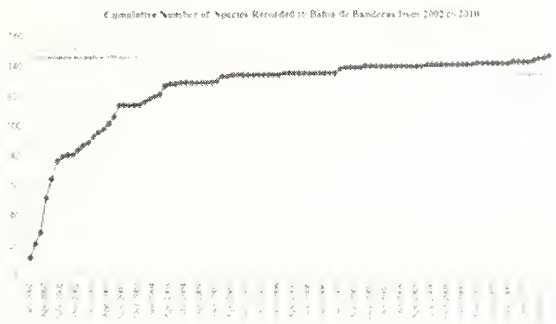

Figure 1. Accumulated number of species observed in Bahía de Banderas from 2002 to 2010.

Oregonian (Cold) Province, from Alaska to Point Conception, California; with low water temperatures (between 8 and 12°C), constant throughout the year. The fauna is characterized by large sized sponges, octocorals, anemones, hydroids, ascidians and bryozoans; significant coverage of red and green macroalgae in giant kelp (*Macrosystis pyrifera*) forests (Keen, 1971).

Californian (Temperate) Province, from Point Conception, California to Punta Eugenia, Baja California; with water temperatures in the range of 14 and 20°C. The water temperature increases moderately in the late summer with the influence of warmer southern currents. Giant kelp forests are found with *Macrocystis pyrifera* and other macro algae like palm kelp and sea grass (*Zoostera*, *Polysiphonia*, *Bryopsis*), sponges, hydroids and bryozooans that grow attached to the rocky bottoms and kelp holdfasts (Keen, 1971).

Panamic (Tropical) Province, from Bahía Magdalena to Ecuador including the Golfo de California with warm waters half of the year, with temperatures over 30°C during the summer and low temperatures of 15°C in spring. This region can present rocky coral reefs of the genera *Porites*, *Pocillopora*, *Pavona* and *Psammocora* to mention the most important ones and the green algae (*Caulerpa*, *Halimeda*, *Codium*) and seasonal growth of brown algae such as *Padina* and *Sargassum* (Keen, 1971).

Figure 2 shows that the faunal affinity of the opisthobranchs of Bahía de Banderas is predominantly Panamic: 98 (67.1 %) of the species have this distribution, with 16 circumtropical species, 11 (7.5%) Oregonian-Panamic and 29 (19.8%) Californian-Panamic. This reflects a species mix that would be expected of a transition zone such as Bahía de Banderas. Nonetheless, the most notable fact of this distribution is not the combination of Panamic, Californian or Oregonian; it is that for 17 of the species (11.6%), Bahía de Banderas is the northernmost and 21 (14.4%) is the southernmost. Moreover, 8 (5.5%) species have so far only been reported at Bahía de Banderas. While this indicates the great diversity and biological importance of the study area, it also reflects the intensity of the work done here. It is likely that the northern and southernmost known locations could be extended with further studies along the Mexican coastline and Central and South America. This information will allow us to have a better idea of the environmental factors that determine where (and when) a species can be found.

The list of opisthobranch species known in Bahía de Banderas (146) represents 62.4% of the 234 species reported for the Mexican Pacific and the Golfo

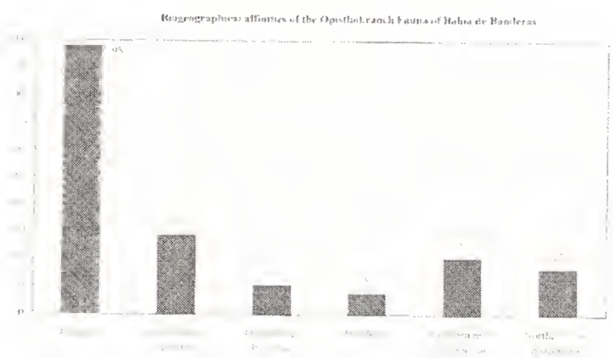

Figure 2. Biogeographical affinities of the opisthobranch fauna of Bahía de Banderas.

de California (Hermosillo et al., 2006). For an area with a 115 km of coastline, while the Mexican Pacific, Golfo de California and its islands measure 8,000 km (INEGI) this percentage reflects a great diversity that would be expected in a transition zone such as Bahía de Banderas (Plate 1 Figures 1-6).

Table I presents the species list of Bahía de Banderas with its known geographical distribution (northern and southern limits) and the classification of such distribution (Panamic, Californian, Oregonian and Bahía de Banderas). For example, *Bulla punctulata* is known from Bahía Magdalena, Baja California Sur to Perú, so it is considered a Californian to Panamic species and represented in the Table as Californian-Panamic. There are species that have only been found in Bahía de

Banderas thus far, the geographical distribution of these eight species is considered as "Banderas"; further studies are necessary to learn if they can be found in localities outside the Bay. The letter "s" in parenthesis after the type of distribution indicates those species for which Bahía de Banderas is the southernmost locality in which the species has been reported; "n" indicates the northernmost.

Table 1. Species list and geographical distribution of the opisthobranch fauna of Bahía de Banderas.

SPECIES	DISTRIBUTION	KNOWN GEOGRAPHICAL RANGE
Bulla punctulata A. Adams in Sowerby, 1850	Panamic	Bahía Magdalena, Golfo de California to Perú.
Haminoea ovalis Pease, 1868	Panamic (n)	Bahía de Banderas to Costa Rica and Panamá.
Navanax aenigmaticus (Bergh, 1893)	Californian-Panamic	San Diego, California to Panamá.
Navanax inermis (Cooper, 1863)	Californian-Panamic (s)	Southern California; Golfo de California to Bahía de Banderas.
Phillinopsis speciosa Pease, 1860	Panamic	Circumtropical.
Aplysia californica Cooper, 1865	Oregonian-Panamic	Oregon, Golfo de California, El Salvador, Japan.
Aplysia cedrosensis Bartsch & Rehder, 1939	Californian-Panamic	Isla de Cedros, Golfo de California to Ixtapa, Guerrero.
Aplysia juliana Quoy & Gaimard, 1832	Panamic	Circumtropical.
Aplysia parvula Winkler, 1955	Panamic	Circumtropical.
Notarchus indicus Scheigger, 1820	Panamic (n)	Indo-Pacific, Mediterranean, Hawaii Bahía de Banderas.
Dolabella auricularia (Lightpie, 1786)	Panamic	Circumtropical.
Dolabrifera dolabrifera (Rang, 1828)	Californian-Panamic	Circumtropical in warm and subtropical waters.
Phyllaplysia padinae Williams & Gosliner, 1973	Panamic	Golfo de California to Costa Rica and Panamá.
Stylocheilus striatus (Quoy & Gaimard, 1824)	Panamic	Circumtropical.
Tylodina fungina Gabb, 1865	Californian-Panamic	South of California, Golfo de California to Ecuador.
Umbraculum umbraculum (Lightfoot, 1786)	Panamic	Circumtropical in warm and subtropical waters.
Berthella stellata (Risso, 1862)	Panamic	Circumtropical.
Berthella grovesi Hermosillo & Valdés, 2008	Panamic	Golfo de California to Panamá.
Berthellina ilisima (Marcus & Marcus, 1967)	Panamic	South of California, Golfo de California to Panamá and Ecuador.
Pleurobranchus aerolatus (Mörch, 1863)	Panamic	Circumtropical.
Lobiger souverbii Fischer, 1857	Panamic	Circumtropical.
Oxynoe panamensis Pilsbry & Olsson, 1943	Panamic	Golfo de California to Panamá.
Berthelinia chloris (Dall, 1918)	Panamic	Golfo de California to Ecuador.
Elysia diomedea (Bergh, 1894)	Panamic	Golfo de California to Panamá.
Elysia hedgpethi Marcus, 1961	Oregonian-Panamic	British Columbia, Golfo de California to Bahía de Banderas.

Elysia pusilla Bergh,1872	Panamic	Indo-Pacificic, Bahía de Banderas to Costa Rica.
Elysia sp. 1	Panamic	Bahía de Banderas to Costa Rica .
Elysia sp. 2	Panamic	Islas Revillagigedo, Bahía de Banderas to Costa Rica.
Cyerce orteai Valdes & Camacho-García, 2000	Panamic	Mexican Pacific to Costa Rica.
Polybranchia viridis (Deshayes, 1857)	Panamic	Golfo de California to Ecuador and the Caribbean.
Placida cremoniana (Trinchese, 1892)	Panamic (s)	Golfo de California to Bahía de Banderas, Guam, Mediterranean, Australia.
Placida dendritica (Alder & Hancock, 1843)	Oregonian-Panamic (s)	Alaska, to Golfo de California and Bahía de Banderas.
Aplysiopsis enteromorphae (Cockerell & Eliot, 1905)	Oregonian-Panamic (s)	Ketchikan, Alaska to Bahía de Banderas.
Aplysiopsis sp. 1	Banderas	Bahía de Banderas.
Ercolania boodleaea (Baba, 1938)	Californian-Panamic (s)	San Diego, California; Puerto Peñasco, Sonora, Golfo de California, Bahía de Banderas.
Corambe pacifica MacFarland & O'Donoghue, 1929	Oregonian-Panamic (s)	Alaska to Bahía de Banderas.
Ancula gibbosa (Risso, 1818)	Cold-Panamic (s)	Alaska, San Diego to Bahía de Banderas.
Okenia academica Camacho-García & Gosliner, 2004	Panamic (n)	Bahía de Banderas and Costa Rica.
Okenia angelica Gosliner & Bertsch, 2004	Panamic	Golfo de California and Pacífico mexicano.
Okenia cochimi Gosliner & Bertsch, 2004	Californian-Panamic	Isla de Cedros, Baja California, Golfo de California, Bahía de Banderas and Islas Revillagigedo.
Okenia mexicorum Gosliner & Bertsch, 2004	Panamic (s)	Golfo de California to Bahía de Banderas.
Trapania goddardi Hermosillo & Valdés, 2004	Californian-Panamic (s)	Bahía Tortugas, Baja California to Bahía de Banderas.
Trapania goslineri Millen & Bertsch, 2000	Californian-Panamic (s)	Isla de Cedros, Baja California, Golfo de California to Bahía de Banderas.
Aegires sublaevis Odhner, 1932	Panamic (n)	Atlantic, Islas Galápagos, Ecuador y Bahía de Banderas.
Limacia janssi (Bertsch & Ferreira, 1974)	Panamic	South Golfo de California, Mexican Pacific to Panamá.
Polycera alabe Collier & Farmer, 1964	Californian-Panamic	California, Golfo de California, Mexican Pacific to Panamá.
Polycera gnupa (Marcus & Marcus, 1967)	Panamic	Golfo de California to Panamá.
Polycera kaiserae Hermosillo & Valdés, 2007	Panamic (n)	Bahía de Banderas to Costa Rica and Panamá.
Polycera sp. 1	Panamic	Islas Revillagigedo to Panamá and Islas Galápagos
Polycerella glandulosa Behrens & Gosliner, 1988	Californian-Panamic	South of California and Golfo de California to Panamá.
Roboastra tigris Farmer, 1978	Panamic (s)	Golfo de California to Bahía de Banderas.

Tambja abdere Farmer, 1978	Panamic	Bahía Magdalena, Baja California , Golfo de California, Mexican Pacific to Costa Rica.
Tambja eliora (Marcus & Marcus, 1967)	Californian-Panamic	Ensenada, Baja California, Bahía de Banderas, Mexican Pacific, Costa Rica.
Aldisa sanguinea (Cooper, 1863)	Oregonian-Panamic (s)	Oregon, Golfo de California to Bahía de Banderas.
Atagema sp. 1	Panamic (n)	Bahía de Banderas; Costa Rica.
Diaulula aurila (Marcus & Marcus, 1967)	Californian-Panamic	Punta Rosarito, Baja California; Golfo de California, Mexican Pacific to Costa Rica and Panamá.
Diaulula greeyeli (MacFarland, 1909)	Panamic	Brazil; Mexican Pacific to Costa Rica.
Discodoris aliciae Dayrat, 2005	Panamic	Golfo de California, Mexican Pacific to Costa Rica.
Discodoris ketos (Marcus & Marcus, 1967)	Panamic	Golfo de California to Panamá.
Geitodoris mavis (Marcus & Marcus, 1967)	Panamic	Mexican Pacific; Costa Rica,; Panamá; Indo-Pacific; Madagascar
Doris immonda (Risbec, 1928)	Panamic (n)	Indo-Pacific; Bahía de Banderas; Costa Rica.
Doris tanya (Marcus, 1971)	Panamic (n)	California, Golfo de California, Mexican Pacific to Costa Rica.
Carminodoris bramale (Fahey & Gosliner, 2003)	Panamic (n)	Bahía de Banderas; Costa Rica, Panamá.
Jorunna tempisquensis Camacho & Gosliner, 2008 (Fig. 4)	Panamic (n)	Bahía de Banderas, Ixtapa, Guerrero; Costa Rica and Panamá.
Paradoris lopezi Hermosillo & Valdés, 2004	Panamic (s)	La Paz, Baja California; Islas Revillagigedo; Bahía de Banderas
Rostanga pulchra MacFarland, 1905	Oregonian-Panamic	Alaska to Chile and Argentina.
Taringa aivica Marcus & Marcus, 1962	Temperate-Panamic	SouthernCalifornia and Golfo de California to Panamá.
Taringa sp. 1	Panamic (n)	Bahía de Banderas; Costa Rica.
Thordisa niesenii Chan & Gosliner, 2005	Panamic (n)	Bahía de Banderas; Costa Rica and Panamá.
Conualevia alba Collier y Farmer, 1964	Oregonian-Panamic	Northern California and Mexican Pacific to Chile.
Cadlina luarna (Marcus & Marcus, 1967)	Panamic	Golfo de California, Mexican Pacific to Panamá.
Cadlina sparsa (Ohdner, 1921)	Californian-Panamic	South of California to Costa Rica; Chile and Argentina.
Cadlina sp. 1 (Fig. 5)	Panamic	Isla Isabel, Islas Revillagigedo, Bahía de Banderas to Panamá and Islas Galápagos.
Chromodoris marislae Bertsch, 1973	Panamic	Golfo de California to Panamá.
Chromodoris norrisi Farmer, 1963	Californian-Panamic	Isla de Cedros, Baja California; Golfo de California, Mexican Pacific to Costa Rica.
Chromodoris sphoni (Marcus, 1971)	Panamic	Golfo de California to Panamá; Ecuador.
Glossodoris baumanni Bertsch, 1970	Panamic	Golfo de California to Perú.
Glossodoris dalli (Bergh, 1879)	Panamic	Bahía Magdalena, Baja California Sur, Golfo de California to Panamá.

Glossodoris sedna (Marcus & Marcus,1967)	Panamic	Circumtropical.
Hypselodoris agassizii (Bergh, 1894)	Panamic	Golfo de California to Perú.
Mexichromis antonii (Bertsch, 1976)	Panamic	Golfo de California, Mexican Pacific to Panamá.
Mexichromis tura (Marcus & Marcus, 1967)	Panamic	Golfo de California, Mexican Pacific to Panamá.
Tyrinna evelinae (Marcus, 1958)	Panamic	Golfo de California, Mexican Pacific to Panamá.
Dendrodoris fumata Rüppell & Leuckart, 1831	Panamic	Golfo de California, Panamá and Colombia.
Doriopsilla janaina (Cooper, 1863)	Panamic	Golfo de California, Mexican Pacific to Perú.
Doriopsilla nigromaculata Cockerell in Cockerell and Eliot, 1905)	Californian-Panamic	California; Golfo de California; Costa Rica.
Marionia sp. 1	Panamic	Mexican Pacific; Costa Rica.
Tritonia pickensi Marcus & Marcus, 1967	Panamic	Golfo de California, Mexican Pacific to Panamá.
Tritonia sp. 1 (Fig. 1)	Panamic	Bahía de los Angeles, Baja California and Bahía de Banderas.
Tritonia sp. 2	Banderas	Bahía de Banderas.
Bornella sarape Bertsch, 1980	Panamic	Golfo de California, Bahía de Banderas; Panamá.
Hancockia californica MacFarland, 1923	Californian-Panamic	California to Costa Rica.
Hancockia sp. 1	Banderas	Bahía de Banderas.
Doto amyra Marcus, 1961	Oregonian-Panamic (s)	Alaska to Bahía de Banderas.
Doto lancei Marcus & Marcus, 1967	Californian-Panamic	Southern California; Bahía de Banderas; Costa Rica.
Doto sp. 1	Panamic (s)	Golfo de California to Bahía de Banderas.
Doto sp. 2	Panamic (n)	Bahía de Banderas and Panamá.
Doto sp. 3	Panamic (n)	Bahía de Banderas and Panamá.
Crosslandia daedali Poorman & Mulliner,1981	Panamic	Golfo de California, Mexican Pacific to Costa Rica.
Notobryon wardi Ohdner, 1936	Panamic	Indo-Pacific, Golfo de California, Mexican Pacific; Panamá.
Lomanotus vermiformis Eliot, 1908	Panamic	Circumtropical.
Lomanotus sp. 1 (Fig. 2)	Panamic	Mexican Pacific.
Lomanotus sp. 2	Banderas	Bahía de Banderas.
Lomanotus sp. 3	Banderas	Bahía de Banderas.
Janolus annulatus Camacho & Gosliner, 2006	Californian-Panamic	California; Bahía de Banderas to Costa Rica.
Janolus barbarensis (Cooper, 1863)	Californian-Panamic	California; Golfo de California, Bahía de Banderas; Costa Rica.
Flabellina bertschi Gosliner & Kuzirian, 1990	Panamic	Golfo de California, Mexican Pacific to Panamá.
Flabellina cynara Marcus & Marcus, 1967	Panamic	Golfo de California, Mexican Pacific to Perú.
Flabellina fogata Millen & Hermosillo, 2008	Banderas	Bahía de Banderas.
Flabellina marcusorum Gosliner & Kuzirian, 1990	Californian-Panamic	Isla Cedros; Golfo de California; Islas Galápagos, Ecuador; Caribbean.
Flabellina telja Marcus & Marcus, 1967	Panamic	Golfo de California, Mexican Pacific to Panamá.

Flabellina vansyoci Gosliner, 1994	Californian-Panamic	Punta Eugenia, Gulf of California to Panamá.
Eubranchus cucullus Behrens, 1985	Panamic (s)	Golfo de California, Mexican Pacific to Panamá.
Eubranchus madapanamensis (Rao, 1969)	Panamic (s)	India and Bahía de Banderas.
Eubranchus rustyus (Marcus, 1961)	Oregonian-Panamic (s)	Alaska to Bahía de Banderas.
Eubranchus yolandae Hermosillo & Valdés, 2007	Panamic	Bahía de Banderas and Islas Marías.
Aeolidiella alba (Risbec, 1928)	Panamic	Circumtropical.
Aeolidiella chromosoma (Cockerell & Eliot, 1905)	Californian-Panamic	Southern California; Golfo de California, Mexican Pacific to Costa Rica.
Aeolidiella indica (Bergh, 1888)	Panamic	Circumtropical.
Spurilla neapolitana (Delle Chiaje, 1823)	Panamic	Circumtropical.
Berghia major (Eliot, 1903)	Panamic	Indo-Pacific, Golfo de California, Mexican Pacific to Panamá.
Cerberilla chavezi Hermosillo & Valdés, 2007	Panamic (n)	Bahía de Banderas and Manzanillo, Colima.
Cerberilla pungoarena Collier & Farmer, 1964	Californian-Panamic (s)	Channel Islands, California; Golfo de California to Bahía de Banderas.
Beaolidia nodosa Haefelfinger & Stamm,1985	Panamic	Circumtropical.
Anetarca armata Gosliner, 1991	Californian-Panamic	Punta Asunción, Baja California; Golfo de California, Bahía de Banderas; Costa Rica.
Bajaeolis bertschi Gosliner & Behrens, 1986	Panamic	Golfo de California, Mexican Pacific to Perú.
Babakina festiva (Roller, 1972)	Californian-Panamic	California, Mexican Pacific, Japan, Bahamas.
Dondice sp. 1	Panamic (n)	Bahía de Banderas to Costa Rica.
Austraeolis stearnsi (Cockerell, 1901)	Panamic (s)	Santa Cruz, Baja California to Bahía de Banderas.
Facelina sp. 1	Panamic	Bahía de Banderas, Île Clipperton.
Facelina sp. 2	Panamic	Golfo de California, Bahía de Banderas to Panamá and Indo-Pacific
Favorinus elenalexiae García & Troncoso, 2001	Panamic	Golfo de California, Mexican Pacific to Costa Rica, Panamá, Ecuador.
Favorinus sp. 1 (Fig. 6)	Panamic	Bahía de Banderas and Ecuador.
Glaucus atlanticus Förester, 1777	Panamic (n)	Circumtropical.
Hermosita hakunamatata (Ortea, Caballer & Espinosa, 2003)	Panamic	Golfo de California, Mexican Pacific to Costa Rica and Panamá.
Noumeaella rubrofasciata Gosliner, 1991	Panamic	California; Islas San Benito, Baja California, Golfo de California to Panamá.
Phidiana lascrucensis Bertsch & Ferreira, 1974	Californian-Panamic	Golfo de California, Mexican Pacific to Panamá.
Phidiana sp. 1 (Fig. 3)	Panamic	Bahía de Banderas.
Embletonia gracilis Risbec, 1928	Banderas	Indo-Pacific; South Africa; Baja California, Bahía de Banderas.
Tergipes tergipes (Forskal, 1775)	Panamic (s)	Mediterranean, Atlantic, Pacific.

Cuthona lizae Angulo & Valdés, 2003	Californian-Panamic	Golfo de California to Panamá.
Cuthona millenae Hermosillo & Valdés, 2007	Panamic	Islas Revillagigedo, Bahía de Banderas, Costa Rica.
Cuthona riosi Hermosillo & Valdés, 2008	Panamic	Bahía de Banderas.
Cuthona sp. 1	Banderas	Bahía de los Angeles, Baja California; Bahía de Banderas.
Cuthona sp. 2	Panamic	Bahía de Banderas to Panamá.
Phestilla lugubris (Bergh, 1870)	Panamic	Baja California, México; Panamá; Islas Galápagos Ecuador; Indo-Pacific.

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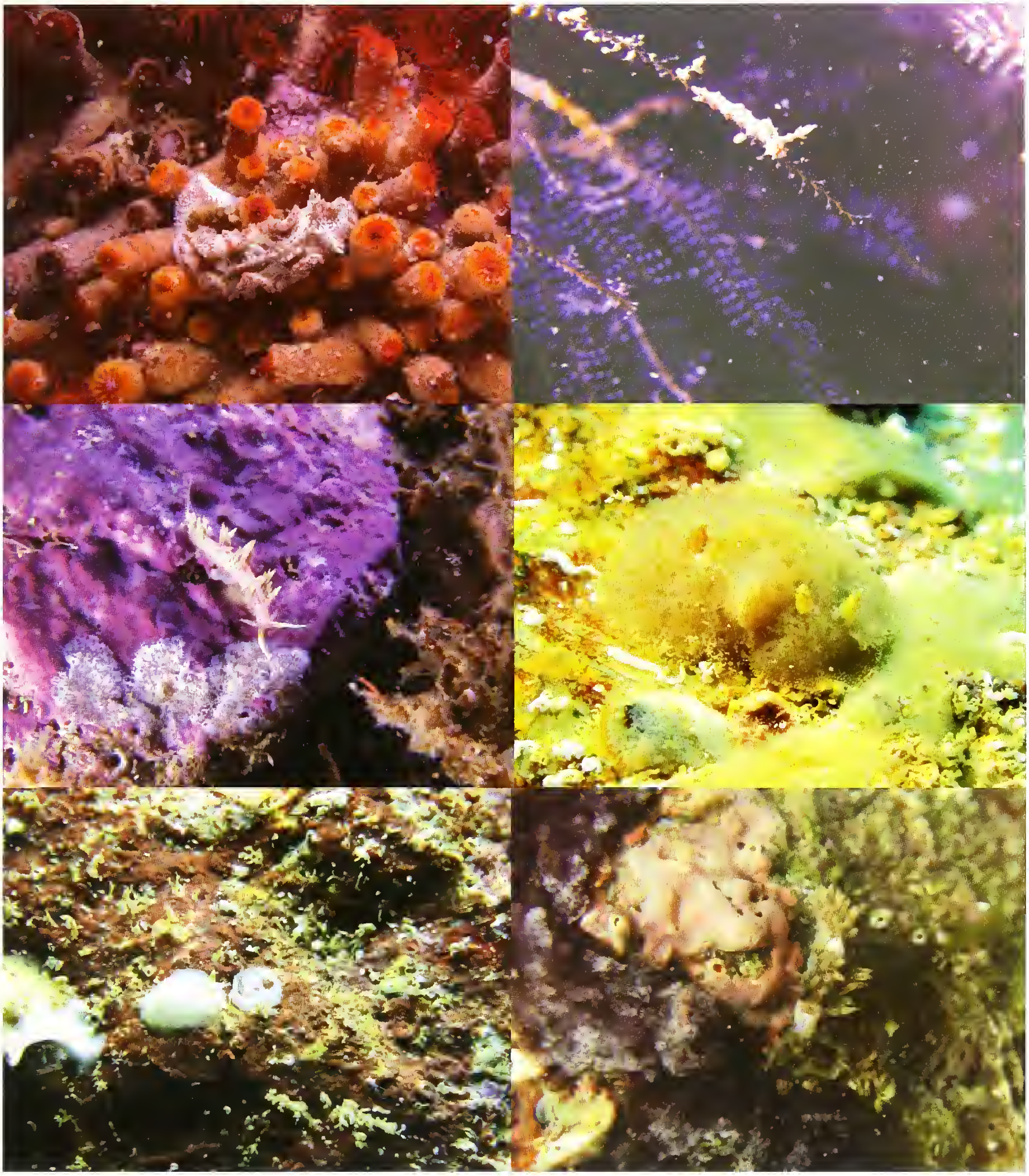

Figures 1-6.
Top row, l -r: (1) *Tritonia* sp. 1, (2) *Lomanotus* sp.
Middle row, l-r: (3) *Phidiana* sp. 1, (4) *Jorunna tempisquensis*
Bottom row, l-r: (5) *Cadlina* sp. 1, (6) *Favorinus* sp. 1.

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THE FESTIVUS

A publication of the San Diego Shell Club

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PROGRAM

Effects of Climate Change and Fishing on Molluscan Biodiversity

Kaustuv Roy is a professor at UCSD whose work in his lab is focused on understanding (a) the processes that shape large scale biodiversity gradients in the ocean and (b) how marine species and communities respond to climate change and other anthropogenic impacts and the long term consequences of such responses.

CONTENTS

Club news 52
The 15th annual SCUM gathering
LINDSEY T. GROVES 54
Book Review: *Octopus The Ocean's Intelligent Invertebrate* by Mather, Anderson & Wood
MEGAN LILLY, reviewer 56
Black Abalone (*Haliotis cracherodii*) on Mission Bay Jetty
PAUL M. TUSKES 57
Errata: *Species List of Opisthobranch Mollusks for Bahía de Banderas (Jalisco-Nayarit), Pacific Coast of México* by Alicia Hermosillo-González, *The Festivus* 43(4): 39-49.
ALICIA HERMOSILLO-GONZÁLEZ 58

CLUB NEWS

The Greater San Diego Science and Engineering Fair - 2011

Once again the Club has participated in the Greater Science and Engineering Fair with the Club's judges this year as Paul Tuskes (Chair), Ann Tuskes and Bob Dees.

Two winners, in a joint project, were chosen, Christine Torres and Emma Jackson. They are eleventh graders at High Tech Hi and their project was, *The Effects of Phamaceutical Ibuprofin on Embryonic Sea Urchins*.

The winners have been invited to share an overview of their project with the Club and receive their awards – a choice between two books – Steinbeck & Ricketts' *Between Pacific Tides* or Barnes' Invertebrate Zoology.

We look forward to hearing about their project.

The Club's Auction/Potluck – 2011

It was a fantastic party enjoyed by all (Figure 1). The 38 people in attendance began arriving at 5 PM to have plenty of time to visit with friends and view the auction tables – silent and voice. Paul Tuskes prepared "Dave's Punch," by now a tradition begun by Dave Mulliner, and there was also wine and soft drinks during the warm evening. At 6:00 PM, it seemed that our always hungry group was more than ready to dig in to the great assortment of delicious, homemade entrees and salads – with plenty for seconds.

At 7:00 PM sharp it was time for the voice auction to begin. Auctioneer Carole Hertz called everyone to their seats and the bidding began. It was an active, noisy and hilarious time. There were many special items – the framed ink drawing of *Latiaxis santacruzensis* by Marty Schuler received an ovation as well as a wonderful bid; the terrific assortment of books, such as the original three volumes of Oldroyd, were vigorously bid on as well as choice shells such as *Cypraea fultoni*, *C. rashleighana*, a dwarf *Cypraecassis rufa*, *Cinclidotyphis myrae*, and *Acanthotrophon sorenseni*.

There were regular visits to the silent auction by the bidders to take advantage of the shells available there and during the mid-evening break in the voice auction, it was dessert, coffee (or other beverage) and a crush of bargain hunters – almost three deep – at the Dollar Table!

During the break, as is usual, members set aside shells in which they were still interested and in the second half, bidding began again with the auctioneer teasing and cajoling the weary attendees to raise the bids on the remaining treasures. Although the auction started on time, it didn't end until 11:00 PM when the last shell was sold. A hearty applause was given by all to celebrate the exciting evening.

The following people generously donated material to the auction: David Berschauer, Twila Bratcher & Billee Dilworth Estates, Carole & Jules Hertz, John Jackson, Arnold Klinckenberg, Margaret Mulliner Estate, Stephen Mulliner, Rick Negus, Lois Nelson, Tony Phillips, Nancy Schneider, Marty Schuler, Carol Skoglund and David Waller.

Many others also worked very hard to make the event the success it was: the Club Board helped in preparing the shells for auction and in setting up the room for the evening. Treasurer Silvana Vollero logged in all the bidding information (and will send bills to the members), Daniel Petroski and Christopher Hume helped distribute the shells, Paul Tuskes bought the ingredients and prepared "Dave's Punch," Jim and Marilyn Goldammer set up the lights which were generously donated to the Club by Nancy Schneider, and Jim also distributed the silent auction material to their new owners. In addition, many thanks also to those unsung heroes who stayed and helped clean up the rooms. And most of all our gratitude to Wes Farmer who has so selflessly hosted the Club auctions continuously for 24 years!!

Figure 1. top row, l-r. Paul Tuskes, Daniel and Christian Petrosky, Wes Farmer, Debbie Catarius, Jim Goldammer. ➜
Second row, l-r. Marilyn Goldammer & David Waller, Rick Negus & Bob Dees, at dinner Bob & Vân Dees, Ann & Paul Tuskes, David Waller & Paul Kanner.
Third row, l-r. Jim Goldammer, Jules Hertz & Larry Buck, Stephen Mulliner, Barbara Myers, Larry Catarius.
Fourth row, l-r. Carole Hertz & Silvana Vollero, George Kennedy, auctioneer at work, Carole Hertz.
Fifth row, l-r. Rick Negus & David Waller, Nancy Schneider with grandkids Christopher & Julie Hume, group at the dollar table.
All photos by Wes Farmer.

THE 15th ANNUAL SCUM GATHERING

LINDSEY T. GROVES

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The 15th annual gathering of the Southern California Unified Malacologists (SCUM) was held on Saturday, March 5, 2011 at the headquarters of the Southern California Coastal Water Research Project (SCCWRP), Costa Mesa, California. The later than usual meeting date was due to a scheduled power outage that was unforeseen at the time of the original scheduling. Twenty-five professional, student, and amateur malacologists, conchologists, and molluscan paleontologists attended the gathering and there were seven first time SCUM attendees present (Figure 1). A tasty continental breakfast was provided by host Kelvin Barwick of the Orange County Sanitation District (OCSD). After the meet-and-greet, Kelvin convened the gathering at 9 AM.

In the time-honored SCUM fashion all attendees were given time to introduce themselves to the group and briefly describe their current research and/or malacological interests. As always, there was a wide variety of molluscan activities ranging from collectors and graduate studies to major research projects. After the introductory portion of the meeting nine attendees presented extended and more detailed versions of their research. Dieta Hanson (Cal. Poly. Pomona) is currently studying the introduced cephalaspidean species *Haminoea japonica* (Pilsbry, 1895) on the west coast and its effect on the native species *H. vesicula* Gould, 1855, and *H. virescens* (Sowerby, 1833). *Haminoea japonica* was first recorded in Washington State in 1986 and subsequently in San Francisco Bay in 2000, possibly due to shipping between Japan and Washington and California, and has been associated with oyster farms. *Haminoea japonica* also appears to be responsible for the introduction of a schistosome parasite to San Francisco Bay as well. It has also been found in Taiwan and Korea and most recently in Italy, Spain, and France. A molecular analysis detected two Japanese haplotypes, one rare and the other common, both different from the haplotypes found in North American and Europe. Additional specimens from Japan are needed to determine the source of the invasive haplotypes.

Jessica Goodhart, also of Cal. Poly. Pomona, is also studying *Haminoea vesicula* Gould, 1855, which ranges from southern Alaska to central Mexico but has been displaced by *H. japonica* in various localities. *Haminoea vesicula* is commonest in estuaries on *Ulva* mats. Specimens were collected under algal mats at low tide in Colorado Lagoon, Long Beach, which is connected to the ocean by pipes. Specimens collected from November 2009 to February 2010 were measured. By far, more specimens were collected in February and specimens were much larger than in other months as well. This indicates a possible end and beginning of subsequent life cycles. She has also studied egg mass development and sizes of the masses. Planktotrophic larvae usually hatch between four and seven days whereas most literature citations say that they hatch between nine and twelve days. This discrepancy may be due to temperature differences. *Haminoea japonica* does not live in southern California possibly due to temperature differences as well. *Haminoea vesicula* has been completely displaced in San Francisco Bay by *H. japonica* but they live together in other areas.

Ángel Valdés (Cal. Poly. Pomona) highlighted his various research projects with students and professional colleagues including: new species of *Dendronotus* from Monterey and Santa Cruz whale falls with unique radulae and anatomy; new *Chromodoris* from Florida that appear to be unaffected by the recent oil disaster in the Gulf of Mexico; new Antarctic nudibranchs whose biology are poorly known; phylogeny of the genus *Polycera*; phylogeny of Aglagidae; and the recognition that *Odontoglaga* is not basal and has possibly reacquired a radula. All of this in addition to his teaching schedule.

Scott Rugh (Escondido, CA) has been working under contract with the US Geological Survey to identify specimens from core samples collected in San Diego Bay including some extinct species. A faunal and depositional environmental comparison between these samples and fossils from the late Pliocene San Diego

Formation showed a striking similarity. Thirty-one species collected at Borderfield State Park in July 2007 from localities collected by George Kanakoff in the 1960s are indicative of an offshore sandy bottom environment probably 70 to 100 feet in depth. Genera included *Barbarofusus*, *Turritella*, and *Kelletia* and various turrids and numerous bivalves. Non-molluscan fossils included otoliths and shark teeth.

John Ljubenkov, who will host SCUM XVI in 2012, gave a presentation on hydroids that have been observed living on various deep and shallow water mollusks. Shallow-water hydroids have been documented living on the gastropod *Lirobittium*, the bivalve *Rochefortia*, and scaphopods. *Halitholus cirratus* has been observed living on the bivalve *Acila castrensis* which lives in shallow and deep-water environments. *Merona* sp. has been observed on *Lirobittium* and *Hydractinia* sp. seen living on dead scaphopods inhabited by hermit crabs. *Manobrachium parasitum* has been observed living on living and dead bivalves.

As always Doug Eernisse (Cal. St. Univ. Fullerton) has numerous research projects with colleagues and students to go along with a full teaching schedule including: new species of *Henricia* seastars (which he considers "honorary mollusks"); DNA barcoding of Indonesian chitons; late Pliocene San Diego Formation chitons; *Fissurella volcano* phylogenetic affinities; *Ostrea* phylogenetics and phylogeography in the Gulf of California; *Lottia scabra* haplotype analysis of northern and southern Californian specimens; north-south species pairs in *Lottia pelta* and *L. insessa*; new species of brooding chitons from Santa Catalina Island; molluscan eye diversity; and numerous other projects.

Another student of Ángel Valdés, Jackson Lam, is studying deep-sea *Armina*, many of which were collected by Philippe Bouchet (NHNM, Paris) during various expeditions to New Caledonia. He will be documenting their reproductive systems, jaws, and radulae. He also presented a short video demonstrating an odd feeding behavior of *Armina* in which they "stand" on the tips of their tails to reach potential food.

Pat LaFollette (NHMLAC Associate) continues to acquire literature dealing with pyramidellid gastropods via internet resources. He has also been collecting fossil specimens of pyramidellids from late Miocene strata near San Gorgonio Pass, Riverside County, CA, that appear to have Panamic and Caribbean affinities. These may include several undescribed species of the genus *Liamorpha* and possibly an undescribed Recent species from Islas Revillagigedos, southern Mexico.

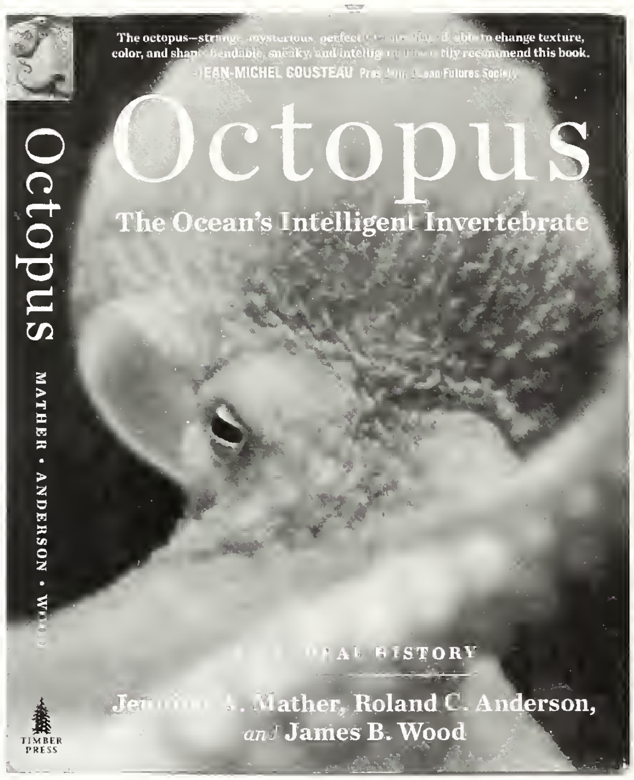
Host Kelvin Barwick (OCSD) made a short presentation on an infaunal sample from 30 m off Goleta, CA that could possibly be bivalves in a brood-sack structure. He posed the question "Is it a bivalve?" as brooding bivalves usually brood within their valves. This may or may not be answered by SCUM XVI.

Despite the postponement, SCUM XV was another successful gathering. For good measure, SCCWRP staff member Ananda Ranasinghe, who provided access to the facility on a day off, was made an honorary SCUM member. SCUM XVI will be hosted by John Ljubenkov at the Cabrillo Marine Aquarium in January 2012.

Figure 1: **Standing:** (l to r): Lindsey Groves, Ananda Ranasinghe, Scott Rugh, James Jacob, James McLean, Kelvin Barwick, Ángel Valdés, Shawn Weidrick, Bill Tatham, **Kneeling** (l to r): Joanne Linnenbrink, Zoe Allen, Lance Gilbertson, Jackson Lam, Pat LaFollette, Bob Moore. Present at SCUM XV but not in photo: James Preston Allen, Doug Eernisse, Suzanne Matsumiya. (Image by Doug Eernisse with the author's camera.)

BOOK REVIEW

Octopus The Ocean's Intelligent Invertebrate.
By Jennifer A. Mather, Roland C. Anderson & James B. Wood
Published: Timber Press, Inc. 2010.
Price: $25.95



I recently finished *Octopus*, *The Ocean's Intelligent Invertebrate*, by Jennifer A. Mather, Roland C. Anderson and James B. Wood. The book takes readers on a journey through the life of an octopus from hatching to senescence. During the course of this journey you learn all there is to know, not only about the basic biology and natural history of this fascinating creature, but also about their intelligence and personality. The combined knowledge of the three authors, and the different perspectives they bring, assures that all aspects of octopuses are covered.

Books of a scientific nature which are written for the general public as well as fellow scientists have the difficult task of providing proper and adequate scientific information without being so technical as to make the book "dry" for the non-scientist. *Octopus* takes on this challenge and manages to find the balance between informative and entertaining. It is written in a casual style that flows nicely, with each chapter addressing a different aspect of octopus biology, behavior, or life history. The last chapter covers other groups within the Class Cephalopoda and contains many interesting facts. For instance - did you know Nautilus can live 15-30 years? I didn't.

Additionally, there are many amusing and anecdotal "insets" throughout the book which tell first-hand stories of experiences the authors had with their charges. Also, the book contains many beautiful color photos of these amazing animals, helpful diagrams which explain and label the external anatomy of an octopus, and a listing of scientific and common names for the referenced species. The postscript by James Wood gives excellent advice on octopus husbandry if anyone is thinking of keeping an octopus in their aquarium.

As a marine biologist with a particular soft spot for octopuses, I found the book both informative and enjoyable to read. For anyone who is interested in octopuses, be it a simple curiosity or a search for more specific information regarding the Order or the Class, I highly recommend this book.

Megan Lilly

This book will be available in the Club library at the May meeting.

BLACK ABALONE *(HALIOTIS CRACHERODII)* ON MISSION BAY JETTY

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While night diving for lobsters on the Mission Bay jetty I found the shell of a black abalone *Haliotis cracherodii* Leach, 1814, at the base of the jetty. The shell looked remarkably clean and I placed it in my catch bag (Figure 1). The next morning when examining the 121 mm shell, I found no staining on the exterior or interior suggesting it had not been buried or exposed to anaerobic conditions. The interior of the shell had four to six circular calcareous tubeworms, each less than 2 mm in diameter. I estimated the animal had died 6-12 months prior to my find. This estimate is based on the condition of the shell, the general lack of fouling organisms, and experience with this tubeworm on other gastropods. The find was reported to Mr. John Butler, head of Marine Benthic Resources Program of the US National Marine Fisheries Service in La Jolla. The shell was donated to their collection.

In San Diego, the black abalone was once a very common species from the intertidal zone to about three meters depth. In the 1960s the species was ignored by both rock pickers and divers due to its relatively small size and the availability of the larger green abalone (*H. fulgens* Philippi, 1845) found commonly during low tides. Rock pickers took blacks if they could not fill their limit with other species. Divers had their choice of green, pink (*H. corrugata* Gray, 1829) and red abalone (*H. rufescens* Swainson, 1822) which were readily accessible; the black abalone were only taken as a novelty. Juvenile black abalone were most commonly found intertidally, and occasionally hundreds could be seen in a very short period of time. In the early 1970s, the South Mission Bay jetty had been the home to the largest black abalone I had seen in San Diego County. The largest specimen I retained is 180 mm but a friend had larger specimens.

Lack of fisheries management in central and southern California allowed pink, green, white (*H. assimilis* Dall, 1878) and black abalone to become severely depleted. In 1976 these four species comprised 65% of the annual commercial catch, the remainder were red abalone, and the total catch was 1,730,111 pounds. In 1986 these same four species represented 56% with a total catch of 614,962 pounds. By 1996 their contribution had plummeted to 0.002% (60 pounds) (Haaker et. al., 2003). The last year of commercial and recreational take of abalone south of San Francisco Bay was 1997. As part of my gastropod studies I make 50 to 60 tank dives a year. I have noticed an increase in the number of juvenile and adult pink and green abalone in my study areas, but it has been three years since I observed a live black

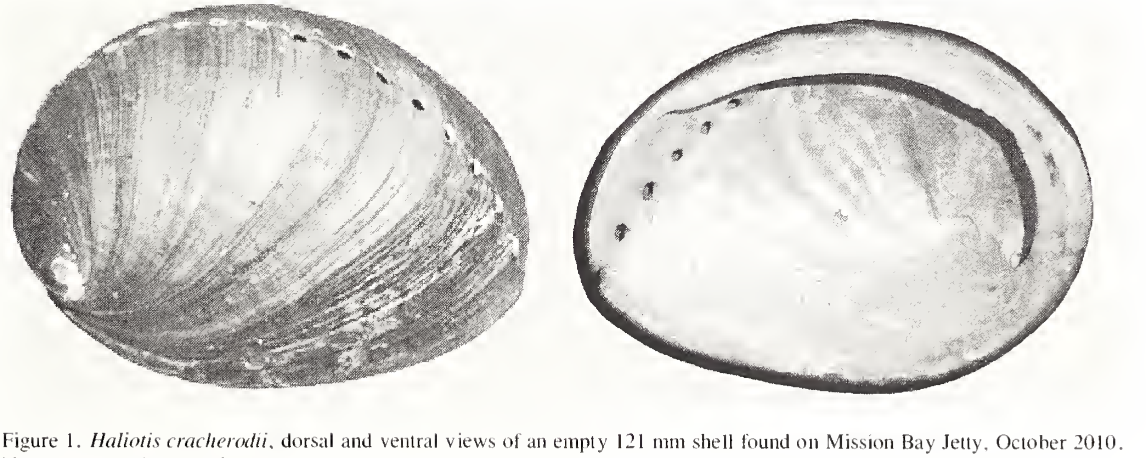

Figure 1. *Haliotis cracherodii*, dorsal and ventral views of an empty 121 mm shell found on Mission Bay Jetty, October 2010. Photographed after cleaning.

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abalone.

Juvenile abalone might have been able to re-establish populations after they were protected, but by then a pathogen called "withering foot" was taking its toll on the abalone population with the black abalone being the most susceptible. Withering foot syndrome is a bacterial disease that inhibits digestive enzymes of the abalone and causes it to starve, and in the process consume its own muscle mass. This disease was first noted from the Channel Islands in 1985. Withering foot syndrome spread to coastal mainland abalone populations in approximately 1992 and is particularly devastating to the black abalone population in the warmer water south of Point Conception. As a result of this disease many local populations in San Diego have disappeared. The distribution of the black abalone is from southern Baja California, Mexico, to Oregon (Cox 1960).

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HAAKER, PETER L, I. TANIGUCHI, J.K. O'LEARY, K. KARPOV, M. PATYTEN & M.. TEGNER
2003. Annual status of the Fisheries Report, section 8, Abalones pp. 1-15. California Department of Fish and Game.
COX, KEITH W.
1960. Review of the Abalone in California. Marine Resources Operations, California Department of Fish and Game 46(4): pp. 381-406.

ERRATA: A mistake in my paper, *Species List of Opisthobranch Mollusks for Bahía de Banderas (Jalisco-Nayarit), Pacific Coast of México*, published in the April issue of *The Festivus* 43(4): 39-49, 6 figs, has come to my attention. The species cited in the paper as *Tritonia* sp. 1, and illustrated in Figure 1 should have been cited as *Tritonia papalotla* Bertsch, Valdés & Gosliner, 2009. I regret that I had not updated the reference for this species. The reference, *A New Species of Tritoniid Nudibranch, the First Found on a Zoanthid Anthozoan, with a Preliminary Phylogeny of the Tritoniidae* by Bertsch, Hans, Angel Valdés and Terrence Gosliner. 2009. was published in Proceedings of the California Academy of Sciences. Series 4, Vol. 60(12): 431-446, 8 figs., 7 tables.

Alicia Hermosillo-González

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THE FESTIVUS

A publication of the San Diego Shell Club

Volume: XLIII June 9, 2011 Number: 6

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Meeting date: third Thursday, 7:30 PM,
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PROGRAM

Field eyes, lab eyes, library eyes:
How Ed Ricketts identified the chitons and limpets collected during the 1940 Sea of Cortez Expedition

Douglas Eernisse of California State University, Fullerton, will present this illustrated program sharing what he calls his latest obsession. His programs are not to be missed.

Meeting date: June 16, 2011

CONTENTS

Club news 60
A new record of *Niso attilioi* (Hertz & Hertz, 1982) from Santa Monica Bay, California
KELVIN L. BARWICK & TONY PHILLIPS 61
A survey of intertidal mollusks with the Pacific Northwest Shell Club at Shannon Point Marine Center, Anacortes, Washington
ALEXANDER P. SASSI 63

CLUB NEWS

San Diego Shell Club Meeting Minutes
19 May 2011

The meeting was called to order at 7:35 P.M. by Jules Hertz, President. The previous minutes were accepted as published. Silvana Vollero gave the treasurer's report. Carole Hertz announced that Larry and Debbie Catarius have offered to host the September party at their house on September 17th. Mark that date on your calendar.

Paul Tuskes introduced Christina Torres and Emma Jackson, 11th grade students at High Tech High, who were recognized by the Club for their Greater San Diego Science and Engineering Fair – 2011 project on the impact of ibuprofen on fertilization and embryonic development of the purple sea urchin.

The dose selected was of concentrations that have been reported in the discharge of water treatment plants, and also ten times the reported concentrations. Their findings showed an increase in the rate of fertilization, but also an increase in abnormalities of developing embryos. The frequency of embryonic abnormalities increased with increased concentrations. Water treatment plants are designed to manage bacteria etc. prior to discharge, but not the wide range of pharmaceuticals that enter the system.

Afterwards, Christina and Emma addressed questions from the members and then Jules Hertz presented each of the young women with a book in recognition of their work. Emma chose Steinbeck & Rickets' *Between Pacific Tides* and Christina chose Barnes' *Invertebrate Zoology*.

Traffic issues prevented Bob Dees from connecting with the planned speaker who generously offered to reschedule his talk at a later date. As a result, Paul Tuskes presented the first of two talks regarding the Mission Bay Survey.

Currently the park encompasses over 4000 acres and has 27 miles of shoreline and a number of distinct habitats. Part one reviewed the history of Mission Bay, the habitats, and some of the early work by Orcutt and Dall. During the current survey 186 species of mollusks were identified and that number is 40% greater than either of two surveys conducted in the 1950s. Although the number of species found intertidally was slightly greater than in the past, the bulk of the additional species were found as a result of both skin and SCUBA diving, tools that were not used in the past.

We also had the opportunity to see photos of the three species of *Mitra* found in the bay and many of our *Tegula* species.

Paul Tuskes

Silent Auctions at Club Meetings

The club is going to have shells for a silent auction starting at the June meeting. All shells will have complete data and be organized by geographical region or family. It will be a great way to acquire specimen material while helping to fund our publication.

After a period of time, we will ask the membership if they enjoy the silent auctions and if they do, we will make it a regular part of our meetings.

Changes to the Roster – 2011

Changes of Address

Phillips, Tony, 17 Vista del Canon, Aliso Viejo, CA 92656

Tucker, John K., PO Box 245, Grafton, IL 62037

The Annual September Party

The annual September Party will once again be held at the home of Debbie and Larry Catarius. It will be on September 17th beginning at 4 PM. The September Party is always great fun and very good eating! So save the date and prepare to attend.

Pacific Conchological Club Shell Auction - 2011

The Pacific Choncological Club announces its annual shell auction on Sunday June 12th from 1:30-4:00 PM at Oakwood Apartments, Toluca Lake [3682 Barham Blvd. between Cahuenga and Forest Lawn Drive.]

There will be both a voice and silent auction with books, corals and shells and lunch with chicken supplied by the club. Participants are asked to bring other potluck items.

For further information, contact Shawn Wiedrick at (714) 235-0633 or shawnwiedrick@hotmail.com to RSVP.

A NEW RECORD OF *NISO ATTILIOI* (HERTZ & HERTZ, 1982) FROM SANTA MONICA BAY, CALIFORNIA

KELVIN L. BARWICK
Orange County Sanitation District, 10844 Ellis Avenue, Fountain Valley, CA 92708, USA.
Email: Kbarwick@ocsd.com

TONY PHILLIPS
City of Los Angeles, Environmental Monitoring Division, Hyperion Treatment Plant,
12000 Vista del Mar, Playa del Rey, CA 90293, USA.
Email: Tony.Phillips@lacity.org

Eulimostraca attilioi was first described by Carole and Jules Hertz in 1982. In their original description they noted certain affinities to the genus *Niso* Risso 1826, but due to the lack of a true umbilicus they placed it in the genus *Eulimostraca*. Warén (1992) later regarded the character of the umbilicus as less important than microsculpture, larval shell and color pattern and placed *Eulimostraca* in the genus *Niso*.

The holotype and paratype were collected in the waters off San Diego, California (C.M. Hertz & J. Hertz, 1982a) (Table 1). Subsequently, C.M. Hertz and J. Hertz (1982b) reported that James McLean of the Natural History Museum of Los Angeles County (NHMLAC) had found two additional specimens in the museum's collection (Table 1).

The new record of *Niso attilioi* (Figure 1) was

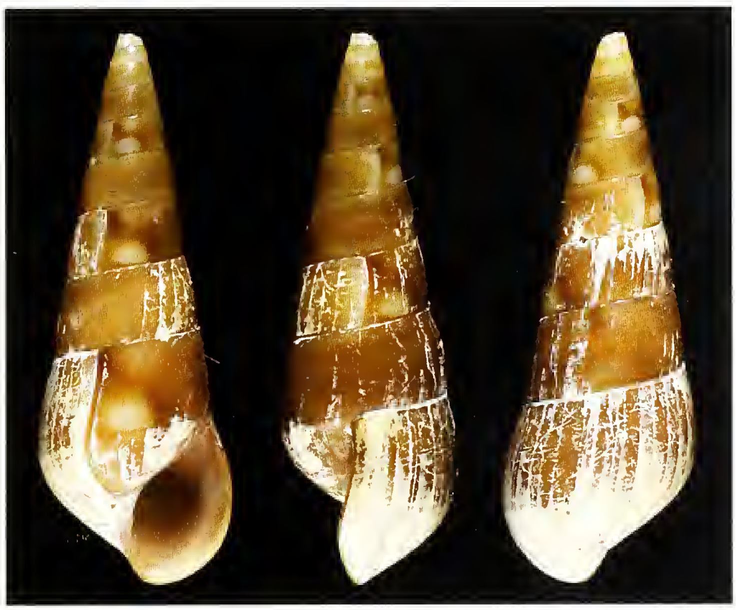

Figure 1. *Niso attilioi* (CLA, EMD Collection) pictured from left to right are ventral, lateral and dorsal views. The shell dimensions are length: 15.7 mm (broken tip); maximum diameter 5.2 mm.

collected by the City of Los Angeles, Environmental Monitoring Division (CLA, EMD) as part of its ocean monitoring program for Santa Monica Bay. It was found at Station FA13, in an infaunal sediment sample collected using a modified Van Veen grab, at a depth of 90 meters. This station is located on the northwest edge of Shortbank (an area of high relief and pillars) and on the southern edge of the Santa Monica Canyon. The sediment was composed of 80% fine shell hash which was unusual for the area. Of interest was the high diversity of both living and dead mollusks found in the sample. This is only the fifth published record of *N. attilioi* from the Southern California Bight.

Literature Cited

HERTZ, CAROLE M. & JULES HERTZ

1982a. A new Pacific species of *Eulimostraca* (Gastropoda: Eulimidae). The Veliger 25(1): 72-76 (July 1).

1982b. Distribution of *Eulimostraa attilioi* Hertz & Hertz, 1982. The Festivus 14(11): 134-135 (November).

WARÉN, ANDERS

1992. Comments on and descriptions of eulimid gastropods from Tropical West America. The Veliger 35(3): 177-194 (July 1).

Table 1. A summary of previously published reports of *Niso attilioi* (Abbreviations: SDMHM (San Diego Natural History Museum); LACM (Natural History Museum of Los Angeles County); AHF (Allan Hancock Foundation)

Locality	Depth	Date Collected	Length (mm)	Maximum Diameter (mm)	Catalog No.	Citation
S of La Jolla Trench off San Diego, CA	90-140 m	Jan.-Jun. 1979*	7.57	3.08	SDNHM Cat. No. 80762 (Holotype)	Hertz & Hertz, 1982a
S of La Jolla Trench, off San Diego, CA	90-140 m	Jan.-Jun. 1979*	8.90	3.17	Hertz Collection (Paratype)	Hertz & Hertz, 1982a
On rock, 20 miles S of San Nicolas Island, CA	65 fathoms	11 Jun. 1941	22.6	--	LACM-AHF 1344-41	Hertz & Hertz, 1982b
Off Gaviota Pass, CA	120 fathoms	Dec. 1973	19.1 (tip broken)	6.8	LACM 80462	Hertz & Hertz, 1982b

*Personal communication, Carole Hertz, February 23, 2011.

A SURVEY OF INTERTIDAL MOLLUSKS WITH THE PACIFIC NORTHWEST SHELL CLUB AT SHANNON POINT MARINE CENTER, ANACORTES, WASHINGTON

ALEXANDER P. SASSI

2617 College Avenue, Apt. 12, Berkeley, California 94704, USA
E-mail: sfalexander@hotmail.com

The sun – not always a common sight in the Northwest even in June – shone as I drove in my rental car to meet members of the Pacific Northwest Shell Club (PNWSC) in Anacortes, Washington, on June 14, 2010. Anacortes is a city of 16,800, about 1.5 hours by car north of Seattle. The occasion was a PNWSC field trip to Shannon Point Marine Center, the marine center of Western Washington University in Bellingham (www.wwu.edu/spmc/). The center is part of a biological preserve, and so we were privileged to be allowed to explore the beach. As I arrived slightly ahead of the 10:30 A.M. meeting time, I went on to nearby Washington Park to see what the beach was like at the park. It is a typical intertidal site for the area with lots of kelp and smooth rocks about five to eight inches in diameter, but had little in the way of mollusks. So, off I went to meet the other club members.

Upon entering the marine center, my eye was immediately drawn to the tall display cases with shells, not all of them from the Pacific Northwest. I met the rest of the club members in the library, which had large glass windows looking out into the forest. Dr. Eugene Kozloff, Professor Emeritus of the University of Washington and author of many books on marine life, was there to greet us, though he was not able to stay. Our host for the day was Dr. Brian Bingham of the Department of Environmental Sciences, who gave a brief introduction to the laboratory and then took us on short tour. He explained several of the research projects, including a survey of the local abalone *Haliotis kamtschatkana* (Jonas, 1845), a project using sea anemones as coral mimics, and testing of wastewater for bivalve mortality. Downstairs near the tanks we spotted an illustrated, laminated guide to intertidal organisms that was new to us: *Intertidal Invertebrates of the Salish Sea* by Adams & Holmes. The Salish Sea is a recent term which describes Puget Sound, the Strait of Juan de Fuca, and the Strait of Georgia. After the tour, he set us loose on the beach.

The tide was to be about minus 3 feet at approximately half past noon. The approach to the beach was on a walkway over the boulders. There, while I was speaking to Linda Schroeder, who had coordinated the field trip, one of the club members found a beautiful, dead, and in nice condition *Ceratostoma foliatum* (Gmelin, 1791) the size of the palm of one's hand – and it was sitting right next to us!

The site itself was within eyesight of the Washington State Ferry Terminal in Anacortes (Figure 1), from which ferries leave to the San Juan Islands and Vancouver Island, British Columbia, Canada. It was surprising to me that such a rich site was next to a commercial terminal. I started out by going to the left, while most members went off to the right. It was slippery walking on the rocks which were covered by wide blades of kelp. Under and around the rocks were limpets, a few chitons, including *Mopalia lignosa* (Gould, 1846) (Figure 2) and some live brachiopods. This is where I found my first *Lottia rosacea* (Carpenter, 1864), about one centimeter in diameter, on a smooth rock. (Figure 3) The animal itself is ringed with a beautiful shade of aqua-green.

As I could see the majority of the members off to the right peering around and under rocks, I decided to join them. This area of the beach with less kelp was much easier to walk. I hunted for the small *Tricolia* among the algae – lots of *Lacuna*, but no *Tricolia*. The adjacent rockier reef area, which jutted out slightly from the shoreline had some more interesting species. Members of the club gathered around cries of "ooh, look" and "what's that?" Among the large rocks we observed *Crassadoma gigantea* (Gray, 1825), which were easy to spot due to their bright orange mantle. A few *Chlamys hastata* (Sowerby, 1842)and bright yellow

juvenile *Crassadoma* had been caught in the tide pools among the larger rocks. On the undersides of turnable rocks we found *Mopalia swanii* (Carpenter, 1864) (Figure 4), the bluish-purple form of *Tonicella lineata* (Wood, 1815) (Figure 5) and the small, creamy white chiton *Leptochiton rugatus* (Carpenter, 1892), which I had never seen before. Other club members commented on the number of *L. rugatus*, as it was being found by the twos and threes on the undersides of rocks. *Ocenebrina lurida* (Middendorf, 1849), *O. interfossa* (Carpenter, 1864), and *Lirularia lirulata* (Carpenter, 1864) were also found in small groups on the underside of rocks,and in the substrate were *Stylidium eschrichtii* (Middendorf, 1849). Commonly found gastropods such as *Nucella lamellosa* (Gmelin, 1791), *N. ostrina* (Gould, 1852), *Calliostoma ligatum* (Gould, 1849), and *Margarites pupillus* (Gould, 1849) were also present, though not nearly as abundant as at other locales. A few *Diodora aspera* (Rathke, 1833) (Figure 6) were found in crevices on the top side of rocks at the edge of the tidepools. *Lottia* sp. and *Littorina* sp. were abundant on and among the boulders and rocks of the higher intertidal zone.

Soon it was 2 P.M. and I had to leave for the airport to fly back to San Francisco. As I left, the group had just started to walk back towards the boardwalk leading down from the marine center, still looking for other species. Approximately 45 species of mollusks were observed that afternoon! A list of those observed follows this article, courtesy of Linda Schroeder (Vice President, PNWSC). A complete list of all species observed by club members at Anacortes over the years can be found on the PNWSC website, www.pnwsc.org.

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ADAMS, M.J. & J. HOLMES
2009. Intertidal Invertebrates of the Salish Sea. Periwinkle Press, Oak Harbor, WA. 8 pp. , 150 invertebrates figured.

SCHROEDER, L. et al.
2010. www.pnwsc.org [website of the Pacific Northwest Shell Club].

PNWSC Shannon Point Field Trip Species List

(compiled by Linda Schroeder, Vice President, Webmaster, and Field Trip Coordinator, Pacific Northwest Shell Club)

Bivalvia	Gastropoda		Polyplacaphora
Chlamys hastata (Sowerby, 1842)	*Acmaea mitra* (Rathke, 1833)	*Lottia instabilis (?)* (Gould, 1846)	*Cryptochiton stelleri* (Middendorf, 1847)
Clinocardium nuttallii (Conrad, 1837)	*Alia carinata* (Hinds, 1844)	*Lottia cf paradigitalis* (Rathke, 1833)	*Lepidozona mertensii* (Middendorf, 1847)
Crassadoma gigantea (Gray, 1825)	*Amphissa columbiana* (Dall, 1816)	*Lottia pelta* (Rathke, 1833)	*Leptochiton rugatus* (Pilsbry, 1892)
Entodesma navicula (Adams & Reeve, 1850)	*Calliostoma ligatum* (Gould, 1849)	*Lottia persona* (Rathke, 1833)	*Mopalia ferreirai* (Clark, 1991)
Leukoma staminea (Conrad, 1837)	*Ceratostoma foliatum* (Gmelin, 1791)	*Lottia rosacea* (Rathke, 1833)	*Mopalia hindsii* (Sowerby, 1847)
Macoma inquinata (Deshayes, 1855)	*Crepidula nummaria* (Gould, 1846)	*Lottia scutum* (Rathke, 1833)	*Mopalia lignosa* (Gould, 1846)
Modiolus modiolus (Linnaeus, 1758)	*Crepipatella dorsata* (Broderip, 1834)	*Margarites pupillus* (Gould, 1849)	*Mopalia muscosa* (Gould, 1846)
Saxidomus gigantea (Deshayes, 1839)	*Diodora aspera* (Rathke, 1833)	*Nucella lamellosa* (Gmelin, 1791)	*Mopalia swanii* (Carpenter, 1864)
Tresus capax (Gould, 1850)	*Lacuna variegata* (Carpenter, 1864)	*Nucella ostrina* (Gould, 1852)	*Tonicella lineata* (Wood, 1815)
Zirfaea pilsbryi (Lowe, 1931)	*Lirularia lirulata* (Carpenter, 1864)	*Ocenebrina interfossa* (Carpenter, 1864)	
	Littorina scutulata (Gould, 1849)	*Ocenebrina lurida* (Middendorf, 1849)	
	Littorina sitkana (Philippi, 1846)	*Odostomia columbiana* (Dall & Bartsch, 1907)	
	Lottia digitalis (Rathke, 1833)	*Stylidium eschrichtii* (Middendorf, 1849)	

Figures 1-6. (1) View from the rocky intertidal site at Shannon Point towards Washington State Ferry Terminal in Anacortes, WA **(2)** *Mopalia lignosa* (Gould, 1846) **(3)** Underside of *Lottia rosacea* (Carpenter, 1864) showing the colorful animal and shell **(4)** *Mopalia swanii* (Carpenter, 1864) **(5)** Blue-purple form of *Tonicella lineata* (Wood, 1815) **(6)** *Diodora aspera* (Rathke, 1833). Photos: A. Sassi.

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PROGRAM

Las Conchas Azules (The Blue Shells): Father Kino, Abalones and the Island of California
[This time we'll get it right!]

Hans Bertsch, a specialist in opisthobranchs and the marine life of the Panamic Province, will present an illustrated program including some of the history and fauna of the areas in the northern Golfo de California.

Also

Slides from the recent Club auction/potluck taken by Wes Farmer will be shown.

Meeting date: July 21, 2011

CONTENTS

Club news 68
Observations on the biology of the Bubble Snail *Bulla gouldiana* in Mission Bay, San Diego, California
PAUL M. TUSKES 69

CLUB NEWS

San Diego Shell Club Meeting Minutes
16 June 2011

The meeting was called to order at 7:36 PM by Jules Hertz, President. The previous minutes were accepted as published. Silvana Vollero gave the treasurer's report. Carole Hertz reminded everyone to save Saturday, September 17th for the September party at the home of Larry and Debbie Catarius. Mark that date on your calendar.

Bob Dees introduced Dr. Douglas Eernisse, whose talk was titled, *How Ed Ricketts Identified the Chitons and Limpets Collected during the 1940 Sea of Cortez Expedition.*" In fact, the talk also covered Ed Ricketts' adult life. For those who don't recognize the name, Ricketts' amazing book, *Between Pacific Tides* was one of... if not the first of its kind. The book was organized by intertidal communities/habitat with copious field notes, rather than a taxonomic list of species.

Ed Ricketts started college in Illinois but promptly left school and headed west to Central California. In 1923 he opened the Pacific Biological Supply Company which provided invertebrates and vertebrates to supply houses. He began the draft of *Between Pacific Tides*, but as a result of significant criticism by a reviewer, which he wished to address, the book would not be published until 1939. In 1930 Ed met John Steinbeck and the two men became close friends and enjoyed philosophy, writing, adventure, and life. Steinbeck also published *The Grapes of Wrath* in 1939. Ed and John planned a collecting trip to Baja California in 1940. They acquired a boat, captain, and a number of other biologists and sailed from Monterey, California to Cabo San Lucas, BCS. From Cabo, they headed north, and in 25 days they made 18 collecting stops and gathered thousands of specimens representing 507-520 species. Ricketts kept daily logs of activities and organized the specimen storage.

After returning to Monterey, Ricketts left for Mexico City, where he learned enough Spanish to use the technical libraries and identify much of the material collected in Baja. He and Steinbeck worked together on a book called *The Log of the Sea of Cortez* which was completed within one year after returning from their trip. By a stroke of good fortune, Ricketts sent the completed manuscript to the publisher just weeks before the famous fire that destroyed Cannery Row and all the belongings of Ed Ricketts. The book was published in late 1941 and they expected it to do well, but within weeks the USA entered World War II as a result of the attack on Pearl Harbor.

Ed Ricketts died shortly after the war in a car-train accident. Ed Ricketts was an outstanding biologist and biological writer and an example of what can be accomplished with interest and determination. Part of Ed Ricketts life was featured in a somewhat accurate movie starring Nick Noltie as Ed Ricketts. Dr. Eernisse gave an excellent presentation.

The meeting was adjourned at 8:40 PM. Members gravitated to the small "silent auction" which Paul Tuskes had set up and which seemed to be enjoyed by members. The Club will continue this for several more meetings and then determine whether or not to continue based on the interest of the attendees.

The door prize was won by Carole Hertz and the refreshments were provided by Nancy Schneider's granddaughter Carlie Lepore and Ann and Paul Tuskes.

Paul Tuskes

The Annual September Party

The annual September Party will once again be held at the home of Debbie and Larry Catarius at 4173 Galt Street, San Diego, 9211. It will be on September 17th beginning at 4 PM . This party is always a potluck with wonderful food. There will be a sign-up sheet at the July and August meetings so that members can let us know what food they will bring. The Club will provide the beverages - beer, soft drinks and wine.

The September Party is always great fun - a chance to get together and enjoy each other's company --and very good eating!

So save the date and prepare to attend. Let us know if you need a map to the Catarius' home.

The Club's Christmas Dinner Party

Yes, it does seem a bit early to announce the Christmas Party. But it isn't too early to mark your calendars. The party will be on the first Saturday in December - the 3rd. And once again it will be at The Butcher Shop - by popular demand.

It will be great fun, as always.

OBSERVATIONS ON THE BIOLOGY OF THE BUBBLE SNAIL *BULLA GOULDIANA* IN MISSION BAY, SAN DIEGO, CALIFORNIA

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Abstract Mature *Bulla gouldiana* live three to four years. Greater than 50% of the shell elongation occurs in the first year. Some individuals may reproduce late in their first season but all animals are reproductively mature during the second season. Approximately one percent of the population lives long enough to reproduce during the fourth season. For mature animals, mortality is highest shortly after reproduction in the third season.

Introduction

Historically, *Bulla gouldiana* Pilsbry, 1895, had been reported from Southern California to Ecuador (Keen 1971) but Malaquias & Reid (2008) have shown the species occurs from Southern California south through the Gulf of California and cited a few records from San Louis Obispo County, California. *Bulla gouldiana* is the only member of the genus present on the west coast of the United States. *Bulla* and other related genera are in the Order Cephalaspidea. A similar West Coast genus is the smaller and more nudibranch-like *Haminoea*, which at times has been mistakenly illustrated in the literature as *Bulla gouldiana*. Two species of *Haminoea* occur on the west coast of the United States, *H. virescens* (Sowerby 1833) and *H. vesicula* (Gould, 1855). An Asian species *H. japonica* Pilsbry, 1895, has been introduced to San Francisco Bay. Unlike mature *Bulla*, members of the genus *Haminoea* in California may envelop their entire semi-translucent white shell and the animals are dark gray, gray-brown or gray-green with white to cream spotting; while in other regions some *Haminoea* species may be very colorful. *Bulla gouldiana* has a gray to gray-brown shell with irregular dark gray markings and the animal varies in color from yellow to orange. *Bulla punctulata* (A. Adams *in* Sowerby, 1850) is smaller with a less inflated shell and occurs from lower Baja California, Mexico to Peru (Keen 1971).

Bubble snails of the genus *Bulla* are widely distributed in tropical and temperate waters. Malaquias and Reid (2008) published a detailed review of the genus based on molecular and morphological studies.They concluded that the genus consists of twelve species worldwide. Many of the species are variable in shell pattern, shape and size, which contributed to the 72 species and 16 varietal names in the literature prior to their study. Identification guides such as McLean (1969) and Morris (1966) illustrate *B. gouldiana* and indicate they are found in bays and lagoons. They are also found offshore on sand flats but at lower densities than in protected bays. Behrens and Hermosillo (2005) published a well-illustrated book on Eastern Pacific opisthobranchs, with generalized biological information for the Cephalaspidea species from Alaska to Central America. Other field guides to the West Coast offer good information regarding intertidal communities, but scant and out-of-date information regarding *Bulla gouldiana* (Niesen, 1984; Brandon & Rokop, 1985; and Sept, 2002).

This paper reports measurements and observations of an in-situ population of *Bulla gouldiana* over a four year period from 2007 to 2010. The findings presented here conflict with commonly published information regarding longevity, diet, and daily bio-rhythms. In Mission Bay, the species does not have a one year life cycle, the animals can be very active during the day, and they are not scavengers.

Methods/Habitat

The *Bulla* population in Ventura Cove, located in west Mission Bay was studied. Observations were made throughout the Cove and into the channel. Measurements that reflect population structure and growth were always collected in the same location. The area sampled bimonthly extended from plus two feet to minus five feet. At approximately minus four feet, the sand slope

drops steeply to a depth of 9 to 12 feet. The slope contains a few patches of eelgrass that become prominent in the deeper water. The sand shelf is swept by tidal currents and the sand is not densely packed. This habitat is markedly different than the inner cove which is not subjected to strong tidal currents and contains more sediment and eelgrass.

Snails were collected randomly on the shelf by pulling a 6 mm mesh net through the sand. The contents of the net were placed in a bucket. After snails were measured, they were placed in a second container and returned to their habitat. Within the study site approximately 300 snails were measured and released every other month. The data were entered into a spreadsheet that generated graphs showing the percent composition of the sampled population by one mm increments. This approach standardizes the data for unequal sample size. *Bulla* in other portions of the bay were observed but not measured.

Snails found at 9-18 feet in depth were observed while SCUBA diving. Many predator-prey interactions, egg laying, and mating clusters were photographed. Observations were made at all depths at least twice monthly. Some mature snails were collected for dissection. Large shells of dead animals were collected and carefully deconstructed to find internal growth lines.

Egg strings were collected and four sections of each string were removed and photographed and the number of egg capsules and eggs per capsule determined. An estimate of the number of capsules and eggs per string was based on the average number of eggs per mm in the four subsamples and length of the string.

Discussion

Feeding: The population of *Bulla gouldiana* studied in west Mission Bay are not scavengers. They graze on the surface of the sand and mud, consuming meiofauna, microscopic algae, diatoms, (Figure 1) and micro and short filamentous algae on blades of eelgrass. The snails do not consume the eelgrass or complex algae. Dissection of adults and examination of the stomach contents identified large amounts of sand. No fragments of marine worms or other macro-invertebrates were detected. The sand and diatom tests pass through the intestines and are expelled. During in-situ tests, *Bulla gouldiana* were not attracted to dead fish, echinoderms, crabs, lobster molts, or other gastropods. *Nassarius tegula* (Reeve, 1853) and *Kelletia kelletii* (Forbes, 1852) were the only gastropods commonly attracted to dead organisms in the study area.

Where large populations of *Bulla* exist, the sand appears clean and turned from bioturbation. Therefore, mats of filamentous algae cannot form even during summer months. Both *Haminoea vesicula* and *Bulla gouldiana* were observed feeding sympatrically on long, thin, filamentous algae in the shallow Model Boat Basin on Vacation Island in Mission Bay. In western Mission Bay, *Haminoea virescens* is usually seen feeding on green filamentous algae associated with rocks in a wide range of habitats including open coastal rocky shores.

Burrowing. Snails of all age classes will burrow into the substrate if exposed during low tide. This behavior prevents desiccation, exposure to direct sunlight and heat. Snails on exposed sand flats may burrow one-half to six inches below the surface of the sand during low tide. Snails that are just below the surface of the sand during low tide remain targets for shore birds as the snails make characteristic bumps in the sand. The Long Billed Curlew, *Numenius americanus;* Marbled Godwit, *Limosa fedoa;* and Yellow Footed Gull, *Larus livens* were observed hunting and feeding on bubble snails in shallow burrows.

Bulla gouldiana also burrows to avoid strong tidal currents, an obvious adaptation to avoid being swept away. Therefore, the number of individuals observed on the surface of the sand is not an indication of the actual population density. Snails also burrow in the open ocean when there is a strong surge on the bottom and, on occasion, when harassed by a diver. Burrowing may also be a means to escape/avoid some of their gastropod predators.

Predation. During the study, *Conus californicus* Hinds, 1844, was the most commonly observed predator followed by the Festive murex, *Pteropurpura festiva* (Hinds, 1844) and the whelk *Kelletia kelletii* (Forbes, 1852). Although *Navanax inermis* (Cooper, 1863), a large Aglajidae also in the Cephalaspidea, occurs in Ventura Cove, and is known to feed on bubble snails, I did not observe them feeding on *Bulla* but did observe empty shells of small to mid-sized *Bulla* and mature *Haminoea virescens* being excreted by *N. inermis*. Mature *Bulla gouldiana* are probably too big for all but the largest *N. inermis* to consume.

The animal of mature *Bulla gouldiana* is too large to withdraw into the protection of its shell. Large *Bulla* were periodically observed with numerous *Conus californicus* feeding on their exposed foot and it is not uncommon to find the *Pteropurpura festiva* feeding with them (Figure 2). Since the muricid was not observed

feeding on the *Bulla* without the cones present, *P. festiva* may be an infrequent opportunistic predator. *Pteropurpura festiva* tends to feed on sessile or slow organisms rather than mobile species (Tuskes & Tuskes, 2009). *Kelletia kelletii* is a massive predator and scavenger with mature specimens measuring 100 to 165 mm. The whelk does not crush the shell of the *Bulla*, but rather manipulates the shell to begin feeding on the exposed animal (Figure 3). Even when the whelk is feeding on a *Bulla*, the cones may continue their attack and feeding. Within the study area, neither the murex, whelk, or *Navanax* occur on the sand shelf, but the cone occurs commonly at all depths.

Reproduction. The reproductive pattern in 2007 was different than in 2008-2010. In 2007 reproduction began in July and by August large snails had moved off the shelf to the deeper water and were in reproductive clusters on the eelgrass. By late August, most individuals in age class four had died after reproducing and large numbers of empty shells to 61 mm could be found. In 2008 and 2009 reproduction began in late April and large clusters were observed through June with few snails in age class four found at depth, and none on the sand shelf. Variation in the start of the reproductive cycle may be influenced by water temperature. In 2010, Ventura Cove surface water temperatures were 58-60° F from June to August (10-15° F less than expected), and no large reproductive clusters of snails were observed and egg masses were uncommon from April to August. In the shallow waters in the northern and eastern portions of the bay, water temperatures reached or exceeded 75° F (mid-day) and reproductive clusters and egg strings were common in June.

A reproductive cluster may contain a few snails or a few dozen in a large mass. Egg capsules are deposited in gelatinous strings that vary in length but are similar in width (Figure 4). The number of egg capsules per mm of string and number of eggs in a capsule is variable (Table 1).The strings were teased out of clusters and it is possible they may have elongated. The number of eggs per capsule and the number of capsules per string would not change, but the number of capsules per mm of string length would be reduced if the string were stretched.

Farfan and Ramirez (1988) conducted laboratory studies on the reproduction and embryonic development of *Bulla gouldiana* in Baja California. Their test animals were fed an artificial diet and maintained at 24° C (75°F). During their laboratory study of 37 days, spawning occurred approximately every fourth day. The number of egg capsules/mm and string length were similar to the current study, suggesting that teasing strings from the mass did not result in notable elongation.

A difference in the results of their study and this paper are the number of eggs per capsule. Farfan and Ramirez (1988) reported one to 30 eggs per capsule and noted that capsules with greater than 12 eggs rarely completed embryonic development. Egg capsules with excessive eggs are a waste of reproductive effort and perhaps an artifact of laboratory conditions and/or diet. During the current study in Mission Bay, the number of eggs per capsule of 10 field-collected strings ranged from 3 to 8 with an average of 4.7 eggs/capsule (Figure 5). The number of eggs per string ranged from a low of approximately 97,000 to a high of nearly 600,000 (Table 1).

In-situ egg strings are exposed to daily and seasonal temperature fluctuations and, as such, developmental time is variable. The temperature of the bay water varies by location and depth, but increases of 12°F or more between April and August are expected. The breeding season can be protracted spanning many months, or compressed to two months. The low summer water temperatures of 2010 were an unusual exception. Most years, late summer water in the study area may approach 78°F at the surface and 73°F at depth. Therefore, eggs deposited in July and August may develop much faster than those laid earlier in the year. During July 2009, development required approximately 2 weeks. Just prior to the larvae exiting the egg capsules, the string changes from yellow to a dull yellow-brown and begins to deteriorate.

Strings of eggs are looped around the eelgrass and the matrix holding the egg capsules adheres to other portions of the same or adjoining strings to form an assemblage that remains attached to the eelgrass (Figure 4). Other hard surfaces such as lobster molts and large empty shells may have strings attached to them if eelgrass is not available. Numerous species of small amphipods and marine flatworms are often associated with egg string clusters.

Growth and Longevity. As the snail matures the shell elongates and widens and each seasonal growth is approximately 0.15 mm thicker than the previous season. This transition is often marked by a growth line, change in shell thickness, and often a change in both pattern and color. Dissection of 54 mature shells allowed the determination of annual shell growth for .

individuals that survived the 3rd and 4th seasons (Table 2) Data revealed that shell length increased the greatest during the first year. For animals that live 3-4 seasons, over 50% of the shell elongation occurs during the first season. Rates of shell elongation are slower but consistent during the second and third seasons, but markedly less during the fourth season.

An additional measure of growth is the amount of shell deposited during each season. Although the shell elongates quickly during the first season, it is thin and fragile. When the weight of shell deposition vs. age class is compared, approximately 10% of the shell weight is deposited the first year, 25% in the 2nd, 44% in the 3rd and nearly 21% in the final season (Table 3). During 3rd and 4th seasons, additional shell is deposited on the columella and internal portion of the previous growth and cannot be removed. As a result, the amount of shell deposited in the first and second seasons is over-estimated and the deposition during the third season is underestimated.

An interesting aspect of shell development is that elongation occurs above and below the protoconch (Figure 6). *Bulla* have an involute spire, and in this case an open umbilicus-like structure extends from the top of the shell down to the protoconch. Another characteristic of the group is that the aperture extends the entire length of the shell. In most gastropods the apex is the oldest portion of the shell and usually the most distant from the aperture.

Bimonthly metrics were not as productive for tracking age classes and subsequently discontinued after 7 cycles and over 2100 measurements. The primary issue was that the width of histogram peaks grew with time and began to overlap. Based on observations and dissection the broad shoulders of the peaks were the result of fast growing individuals catching up to the previous age class and slow growing individuals appearing to be part of a more recent class.

Sampling on the sand shelf in late August 2007 suggested the previous year's age class ranged in size from 21 to perhaps 35 mm with a peak from 28 to 30 mm. While SCUBA diving in mid-September of 2007 many new bubble snails were observed on sand patches at a depth of 12 feet. Their sizes ranged from 3.4 to 7.6 mm with a median of 5.6 mm. In late October recruits appeared on the sand shelf and ranged in size from 8 to 15 mm. By late December 2007 there was no discernable gap in the histograms between the recruits and the previous age class. The sampling identified (1) when massive numbers of recruits left the deeper water reproductively active snails left the shelf for deeper water, (3) the size of individuals (22-34 mm) that remained on the shelf and did not engage in reproductive activity, and (4) in 2007 and 2008 less than one percent of the population survived to reproduce during the 4th season.

Based on the collection of empty (undamaged) shells, mortality for age class 3 snails is significant shortly after completing reproduction that year. No snails were found that survived past age class 4. During the summer of 2010, with water temperatures cooler than normal in the study area, no age class four individuals were found. The longevity of snails further south in their range is not known.

Conclusions

In Mission Bay, the biological rhythm of this species varies by location and by year. *Bulla gouldiana* may be active both day and night. During strong tidal currents most animals will burrow and seemingly disappear whereas in quiet coves they may be out grazing until the low tide nearly exposes them. The reproductive effort in one part of the bay may be protracted and in others very compressed and observations suggest that water temperature is an important factor. Variability in habitat and water temperatures within the bay produces a mosaic of environmental conditions that impact both growth and longevity.

Acknowledgments

I thank Ann Tuskes, Jennifer Kelly, and Larry Catarius for assisting with recording measurements and Ann Tuskes for reviewing the manuscript prior to submission. Thanks also to the unknown reviewers and Carole Hertz editor of *The Festivus*.

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Table 1. Eggs, egg capsules, and string
STD* = Standard Deviation

No. of egg strings	String length mm	No. of egg capsules per mm	Estimated no. egg capsules per string	Average no. of eggs per capsule	Standard deviation of eggs per capsule	Estimated no. of eggs per string
1	763	51	38,913	4.5	0.83	175,108
2	746	78	58,188	5.9	0.78	343,309
3	639	67	42,813	3.5	0.51	149,846
4	1183	89	105,287	5.7	1.23	595,416
5	480	87	41,760	5.4	0.87	227,520
6	820	92	75,440	4.4	0.87	334,091
7	630	81	51,030	4.3	0.68	217,289
8	811	101	81,911	4.4	0.49	358,068
9	440	48	21,120	4.6	0.96	97,152
10	685	83	56,955	4.5	0.76	255,848
Average	720	77.7	57,342	4.7		275,365
STD*	207	17.4	24,442	0.7		141,793

Table 2. Shell Length vs Age Class

	N=14	N=14	N=40	N=40
	Average Length	% of total length	Average Length	% of total length
Season 1	30.3 mm 1.5 STD	52.8%	31.5 mm 2.5 STD	59%
Season 2	41.3 mm 2.3 STD	19.2%	41.2 mm 2.9 STD	18.2%
Season 3	53.4 mm 1.5 STD	21.0%	53.3 mm 2.5 STD	22.8%
Season 4	57.4 mm 2.4 STD	7%	---	---

Table 3. Shell Deposition in grams, in relation to Age Class

N=6	Shell Weight at Death	Deposition Season 1	Deposition Season 2	Deposition Season 3	Deposition Season 4
1	5.09gr	0.40gr	1.47gr	1.72gr	1.51gr
2	5.31	0.54	1.49	2.49	0.79
3	4.94	0.43	1.08	2.51	0.92
4	4.61	0.48	1.39	2.07	0.67
5	5.16	0.55	0.83	2.63	1.15
6	4.98	0.60	1.33	1.83	1.21
Age Class AVG	5.01gr	0.50gr	1.26gr	2.21gr	1.04gr
STD	0.24	0.08	0.26	0.39	0.31
% of Shell Deposition		9.96 %	25.22%	44.03%	20.79%

Figure 1. Mature *Bulla gouldiana*.

Figure 4. Small collection of *Bulla gouldiana* attached to egg strings.

Figure 2. *Conus californicus* and *Pteropurpura festiva* feeding on *Bulla gouldiana*.

Figure 5. Each cluster of eggs is contained within the clear membranous egg capsule.

Figure 3. *Kelletia kellettii* with *Bulla* firmly in its grasp. Note the California cones are still feeding.

Figure 6. Lower arrow points to the location of the protoconch buried within the shell. The extent of involution in this specimen is approximately 6.5 mm.

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Meeting date: third Thursday, 7:30 PM,
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PROGRAM

Interesting Trochids, Turbinids, Naticids, Muricids and other Gastropods from Southern California

Paul Tuskes will talk about some of our rare, not-so-rare and commercially used gastropods, and present observations on their biology, behavior and occurrence. He has published a number of papers on these subjects and has spoken in the past of Florida Tree Snails, Hawaiian shells and his studies on Mission Bay.

Meeting date: August 18, 2011

CONTENTS

Club news 78
Notes on a Californian pectinid species
CAROLE M. HERTZ & BARBARA W. MYERS 79
An expanded survey of the marine mollusks of the island of Saint Kitts, Leeward Islands, West Indies
SUSAN J. HEWITT 83

CLUB NEWS

San Diego Shell Club Meeting Minutes 21 July 2011

The July meeting was called to order by President Jules Hertz at 7:45 PM. The minutes were accepted as published in *The Festivus* and there were no reports from the treasurer and corresponding secretary since they were on vacation. Vice President Bob Dees outlined the speakers for the next few months. A sign-up sheet was passed for the September party to be held once again at the home of Debbie and Larry Catarius.

Hans Bertsch, Chair of the WSM Student Grant Committee, read a letter announcing the winners of the 2011 Student Grant and thanking the San Diego Shell Club for its donation to the Grant.

There were two winners and each received $1000. The first place winner, Alejandra López Galán's project was "Determinación de la edad y crecimiento del pulpo *Octopus hubbsorum* Berry, 1953...mediante el análisis de anillos de crecimiento en el estilete." [Determining the age and growth of the octopus *Octopus hubbsorum* by means of the analysis of rings of growth in the stylet.]

The second place winner, Brittney Dlouhy's project was entitled "Thread drifting among juvenile bivalves on the southwest Oregon coast."

The Club has contributed to the WSM grant for many years. The next annual meeting of the WSM will be in Santa Cruz, California in June of next year.

Bob then introduced the speaker – Hans– who spoke on the life and career as scientist of Father Kino and his fascination with the "Blue Shells." He spoke of the many years that Father Kino was in México and how he'd been given blue abalone shells (interior nacre) also receiving them again 14 years later. These shells were part of the impetus for Kino's travels to find the source of the shells.

It had been believed that Baja California and what is now the state of California were one grand island. Kino's studies and travels proved that Baja is a peninsula distinct from the state of California.

The meeting was adjourned at 8:40 PM. Evelyn Smith won the door prize and the refreshments were provided by the Smiths and the Hertzes.

Too Late for the Roster

Small, Michael, 32 Mugga Way, Red Hill, ACT 2603, Australia. E-mail: michaelsmall@bigpond.com

The Annual September Party

The annual September Party will be on Saturday September 17th beginning at 4 PM until ? It will be held at the home and garden of Debbie and Larry Catarius at 4173 Galt Street, San Diego, 92111. (If you need a map, contact Carole and Jules Hertz [jhertz@san.rr.com] and one will be sent to you.)

The party is always a potluck, and the sign-up sheet will be passed again at the August meeting. If you are unable to attend the August meeting and want to come to the party, call Carole Hertz (858-277-6259) and let her know whether you will bring a main dish, salad or dessert – all to serve 12. As always, the Club will supply soft drinks, beer, wine and coffee.

The September Party is a special event – a chance to just get together and have great food and visit with one another – and even talk shells!

So save the date and come to the party.

A Book Donation to the Club library

Our thanks to Hans Bertsch for the donation of the book *Perspectivas en Malacología Mexicana* to the Club's library. The book, completely in Spanish, was published in 2010 by the Universidad Juáres Autónoma de Tabasco by compilers Rangel Ruiz, Gamboa Aguilar, Arriaga Weiss and Contreras Sánchez. This soft-covered book of 259 pages includes thirteen papers on different aspects of malacology in México.

He also donated two other small publications.

The Club's Christmas Dinner Party

Just a reminder that the Club's Christmas party will be on the first Saturday in December – the 3rd. And once again it will be at The Butcher Shop – by popular demand.

NOTES ON A CALIFORNIAN PECTINID SPECIES

CAROLE M. HERTZ & BARBARA W. MYERS

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Introduction

In the process of curating the Pectinidae in the Department of Marine Invertebrates in the San Diego Natural History Museum, we had problems identifying four lots of a small pecten from 6.0 to 13.0 mm in height from Catalina Island, Southern California (Figure 1). We reviewed the literature and found no specimens illustrated that resembled our small ones (Raines & Poppe, 2006; Coan, Scott & Bernard, 2000; Rombouts, 1991; McLean, 1978; Abbott, 1974). Our task was to identify these small pectinids.

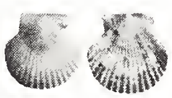

Figure 1. Pecten juvenile specimen, two views, 12.0 mm H from Catalina Island California, in 30 fm (SDNHM 31253). Photo: Paul Tuskes.

Material Studied

SDNHM 5556. 2 specimens, 73.0 & 98.3 mm H, San Pedro, California.
SDNHM 10200. 1 specimen, 26 mm H and 1 broken valve, Isla Guadalupe. Leg. C.L. Hubbs, 1954.
SDNHM 10022. 1 left valve, 44.0 mm H, Isla Guadalupe, Leg. C.L. Hubbs, 1950.
SDNHM 18407. 3 specimens, 77.0-91.5 mm H, Redondo, California.
SDNHM 20508.1 specimen, 23.5 mm H, South Coronado Island, México.
SDNHM 31241. 21 specimens, 22.9 to 104 mm H, San Pedro, California, H.N. Lowe Estate, donor.
SDNHM 31253. 13 specimens, paired 6.0-13.0 mm H and 5 valves. Catalina Island, California in 30 fm.
SDNHM 56268. 4 specimens, 60.4-97.5 mm H, San Pedro, California.
SDNHM 56254. 2 specimens, 52.5 & 53 .0 mm H +2 adult valves, San Pedro, California, H.N. Lowe, donor.
SDNHM 61290. 10 valves, 8-11.9 mm H, Catalina Island, California.
SDNHM 68143. 7 valves, 6.5-13.0 mm H, Catalina Island, California.
SDNHM 73749. 4 specimens, 7.1-11.9 mm H and 8 valves, Catalina Island, California.
SDNHM 93493. 14 valves, 9.5-30.9 mm H, Point Conception, California [34°17'N, 120°26'W].

Discussion

We studied the characters of our small pectinid (17 pairs, 30 valves) from 6.0-13.0 mm H and determined the exterior of the left valve to be flat to concave in a colorful orange to red with a cream background and 18 to 20 raised, rounded ribs with fine, closely spaced commarginal lamellae overriding the ribs and interspaces. The auricles (ears) in the flat valve (left) are almost equal; the interior of the valve glossy with the rib area reddish along the ventral margin. The exterior of the right valve is convex with 19-20 rounded ribs and closely spaced fine commarginal lamellae overriding ribs and interspaces. The exterior color varies from white to rose to tan. Auricles in the right valve are similar to *Chlamys*, an elongate right ear with an indentation where the ear meets the body of the shell at the byssal fasciole as in *Chlamys*. In only one juvenile studied (SDNHM 20508, size 23.5 mm H) was a ctenolium visible.

We compared our small specimens with other pectinid species from Southern California and we found that the only local species with a juvenile having a flat to concave left valve was *Euvola diegensis* (Dall, 1898) a new name for *Pecten floridus* Hinds, 1844 (Coan, Scott & Bernard, 2000) (Figure 2) with the genus later changed to *Leopecten* by Waller (2007). However, the adult *Leopecten diegensis* has a somewhat convex left valve, not flat or concave as in the small specimens we were studying. In the right valve of the adult, the right auricle becomes more like the left except for the inden-

tation leading into the byssal fasciole. The right auricle of the right valve in our small specimens is different than that of the adult *L. diegensis* in having an elongated right auricle with an indentation into the byssal fasciole. Other differences in the adult specimens are in the disk. The tops of the 19-20 ribs in the left valve in the adult are rounded and the commarginal lamellae are faint. In the right valve the 19-21 ribs are squared, flattened and grooved centrally; the commarginals are faint and appear more like growth lines (Figure 3), whereas in the juveniles the ribs are rounded and the commarginal lamellae are closely spaced and sharp in both valves. The color of the exterior of the right valve in the adult is yellow to tan with the left valve a reddish brown. In the juveniles the right valve varies from pale cream to rose and the left valve is colorful with a reddish cream patterning both exteriorly and interiorly.

Results

We then examined pectinid lots in the collection looking for any that would have juveniles mixed with adults. The breakthrough came when we looked at a large lot with 14 adult specimens of *E. diegensis* including 3 shells and 1 left valve of juveniles from 22.9 to 39.9 mm (SDNHM 31241) (Figure 4). These specimens still had the flat, (though the larger ones were not concave), left valve and in the right valve the right auricle indented into the byssal fasciole. As we looked at larger subadult specimens (from 40 - 56 mm) (Figure 4) we found that the left valve became somewhat more convex and the byssal fasciole less visible. In the right valve the ribs were still rounded with no central groove and the commarginals were still visible and sharp. At this point we considered that our tiny pectinids might very well be juvenile *Leopecten diegensis*.

We sent photographs of two specimens of 12 mm shells to Paul Valentich-Scott, Curator of Malacology at the Santa Barbara Museum of Natural History, requesting his opinion of our identification of the shells. After checking their collection, he responded, "I have compared your images to some of our small specimens here and they match quite well."

At the suggestion of Valentich-Scott, we studied the paper by Waller (2007) and found the precise description of our specimens which he placed in the genus *Leopecten* Masuda, 1971. Waller noted, from the description in Masuda (1971) that in the early development of *Leopecten*, the left valve is concave, but as the specimen matures this valve becomes slightly convex, a defining character that we had found in our study of shells of *diegensis* from juvenile to mature.

As we continued working with these beautiful pectens, Dr. Tom Déméré, Curator of Paleontology at the Museum, was passing through the department and noticed our table filled with *Leopecten diegensis*. He stopped to see the specimens and as we chatted he mentioned that the Paleontology Department had the Pliocene antecedent of *L. diegensis* and he brought in 2 lots (one of 12 adult specimens and one of 6 and 15 valves between 35.0 to 84.0 mm) of beautifully preserved Pliocene specimens of *Flabellipecten stearnsii* (Dall, 1878) (SDNHM 80 and 5) described from the San Diego Formation and collected on the south slope of Soledad Mountain, San Diego County (Figure 5) one lot collected by U.S. Grant IV in 1928, the other by Frank Stephens in 1927.

Significant differences that we noticed were that in the adult *stearnsii* the left valves retained the flattened and/or concave appearance with the sharp commarginals of our Recent juveniles and subadults. However, the valves of *stearnsii* have a greater number (23-26) of squared ribs, some slightly grooved with narrower interspaces than those of the Recent *Leopecten. diegensis*.

Grant & Gale (1931) had thought that *Leopecten diegensis* was a subspecies of *Flabellipecten stearnsii*, but Hertlein & Grant (1972) considered "the differences are sufficient to justify separate species." It is now known that the Pliocene *Flabellipecten stearnsii* is a different species from the Recent *Leopecten diegensis*.

The published distribution of *Leopecten diegensis* is from Bodega Bay, California to Cabo San Lucas, Baja California, México (Coan, Scott & Bernard, 2000 and Waller, 2007). The specimens we studied were from Pt. Conception, San Pedro and Catalina Island, California, and Islas los Coronados and Isla Guadalupe off Baja California, México.

Figure Captions. **Figures 2-5.** **(2)** *Leopecten diegensis* (Dall, 1898), four specimens with views of right and left valves. L-R: 12.0, 13.1, 22.0 and 23.5 mm H. (SDNHM 31253, 31241 & 20508). Photo: Paul Tuskes. **(3)** *Leopecten diegensis*, two views of 104 mm H adult from San Pedro California (SDNHM 31241 ex H.N. Lowe Estate). **(4)** *Leopecten diegensis*, two views of four subadult specimens: L-R: 40, 48, 54 and 56 mm H from San Pedro, California (SDNHM 31241 ex H.N. Lowe Estate). **(5)** *Flabellipecten stearnsii* (Dall, 1874), two views of an adult 83 mm H, (SDNHM locality 80, specimen 128548, Paleontology Collection). Pliocene, San Diego Formation, south slope of Soledad Mountain. Leg. U.S. Grant, IV, 16 August, 1928. →


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Acknowledgments

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AN EXPANDED SURVEY OF THE MARINE MOLLUSKS OF THE ISLAND OF SAINT KITTS, LEEWARD ISLANDS, WEST INDIES

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Introduction

This paper is a continuation of a study begun in 2009 (Hewitt, 2011) when 44 species of marine mollusks were recorded in 40 minutes by the author from beach drift at Majors Bay on the southeastern peninsula of the West Indian island of Saint Kitts. That island (17°15'N, 62°40'W) is part of the inner arc of the northern part of the Leeward Island chain of the Lesser Antilles (for a map see Hewitt, 2011). At 168 sq km with a population of 35,000, St. Kitts is the larger of the two islands within the Federation of St. Kitts and Nevis.

On April 14, 2010, my husband and I were picked up at the international airport in St. Kitts and driven to the "Sea Bridge" ferry dock in Majors Bay (17°13.63'N, 62°38.80'W) in order to catch the ferry over to Nevis for our annual trip. Majors Bay is at the southern tip of the southeastern peninsula of St. Kitts, situated between a long headland called Nags Head to the west and a shorter headland to the east. The bay is relatively sheltered from wave action, except for swells coming from the south. From the mouth of the bay it is about 3 km southeast to the corresponding Nevis ferry dock at Cades Bay, across the channel known as "the Narrows" between the two islands.

Text figure 1. View of Majors Bay looking southwest; the headland Nags Head in the left distance, the rocky south end of the beach to the right. Image: Edward Subitzky.

Text figure 2. View of Majors Bay from the Sea Bridge ferry, including sand spit and "Majors Pond" behind it. Image: S. Hewitt.

In April and May 2010, Majors Bay was still more or less a wild locality (Text figure 1). However, a high-end tourism development company currently owns and is developing over 1,000 hectares (2,600 acres) in the southeastern peninsula of St. Kitts, a parcel of land that includes Majors Bay. In May 2010, landscape alterations for this project had already started to make significant changes in other parts of the peninsula, but not yet at Majors Bay. The terrain included a hyper-saline lagoon cut off from the sea by a broad and mostly well-vegetated sand spit (Text figure 2). The only development was a road leading to a ferry docking ramp, with a small wooden gazebo.

My husband and I arrived at the bay with about an hour remaining until the next ferry departed. I searched for and recorded several species of marine mollusks living on the rocks at the west end of the bay. (The West Indies has a very small tidal range, approximately 25 cm, and as a result there is only a small intertidal zone; the difference between high tide and low tide is often barely noticeable.) I hand-picked shells from the beach drift along a large stretch of the sandy shoreline.

Five days later, on April 19th, my husband and I made a return visit to Majors Bay via the ferry from Nevis, staying two hours. I again searched for live mollusks at the west end (rocks) and at the east end (gravel and cobblestones). I also searched the whole length of the sand beach itself for beach drift shells.

On April 27th, eight days later, we made yet another visit, staying for another two hours. On arriving, I snorkeled out to the first rocky point on the east end of the bay and back, picking up a number of shells on patches of sand near turtle grass (*Thalassia testudinum* Banks ex König). I then searched (and hand-picked) the beach drift on the sandy shore of the bay for an hour.

The following list shows species that were found in 2010 on Majors Bay. Although a number of live species were found, the majority of species were dead shells (either whole or fragments) that were hand-picked from the beach drift. Some of the live animals found in 2010 were species that had already been recorded in my previous paper about Majors Bay (Hewitt, 2011), which listed only dead shells found in 2009. Species listed in the previous paper that were found once again in 2010 as dead shells are not included in this list.

Species found in 2010 on Majors Bay

Families are listed in taxonomic order: gastropods following Bouchet & Rocrois (2005) and bivalves following Mikkelsen & Bieler (2007). Binomial epithets are taken from Rosenberg (2009).

List of notations: **L**=live: observed live on rock surfaces; **O**= old: one very worn shell only; **B**=bait: whole chiton shell, soft parts apparently used as bait; **S**=snorkel: dead shells found in 3 m depth by snorkeling; **M**=Malacolog: already listed in Rosenberg (2009).

CLASS GASTROPODA

Lottiidae

Lottia "morphotype B" as per Hewitt (2009) **L**
Lottia albicosta (C.B. Adams, 1845)
Tectura antillarum (Sowerby I, 1843) L

Fissurellidae

Diodora arcuata (Sowerby II, 1862)
Diodora listeri (d'Orbigny, 1842)
Diodora variegata G.B. Sowerby II, 1862
Fissurella angusta (Gmelin, 1791)
Fissurella nimbosa Linnaeus, 1758 **L**
Hemitoma octoradiata (Gmelin, 1791) S
Lucapina suffusa (Reeve, 1850)

Trochidae

Tegula excavata (Lamarck, 1822) L
Tegula hotessieriana (d'Orbigny, 1842)

Turbinidae

Astralium phoebium (Röding, 1798) S

Phasianellidae

Eulithidium affine (C.B. Adams, 1850)

Neritidae

Nerita peloronta Linnaeus, 1758 L
Nerita tessellata Gmelin, 1791 L
Nerita versicolor Gmelin, 1791 L
Smaragdia viridis (Linnaeus, 1758)

Cerithiidae

Cerithium atratum (Born, 1778)
Cerithium eburneum Bruguière, 1792
Cerithium lutosum (Menke, 1828)

Planaxidae

Hinea lineata (da Costa, 1778) L
Supplanaxis nucleus (Bruguière, 1789) L

Turritellidae

Vermicularia knorri Deshayes, 1843

Calyptraeidae

Bostrycapulus aculeatus (Gmelin, 1791) S
Crepidula sp. A (white shell)
Crepidula sp. B (orange-brown shell)

Rissoidae

Rissoina sp. (too worn to determine sp.) O

Littorinidae

Echinolittorina angustior (Mörch, 1876) L
Echinolittorina meleagris (Potiez & Michaud, 1838) L
Echinolittorina tuberculata (Menke, 1828) L
Echinolittorina ziczac (Gmelin, 1791) L

Strombidae

Eustrombus gigas Linnaeus, 1758

Ranellidae

Cymatium labiosum (Wood, 1828) M

Hipponicidae

Hipponix antiquatus (Linnaeus, 1767)
Hipponix costellatus Carpenter, 1856

Triphoridae

Nototriphora decorata (C.B. Adams, 1850)

Buccinidae

List continued

Antillophos unicinctus (Say, 1825)
Columbellidae
Columbella mercatoria (Linnaeus, 1758)
Mitrella ocellata (Gmelin, 1791)
Nitidella nitida (Lamarck, 1822)
Muricidae
Coralliophila abbreviata (Lamarck, 1816)
Cystiscidae
Persicula sp. (too bleached to determine sp.)
Turbinellidae
Vasum muricatum (Born, 1778) O
Olivellidae
Olivella exilis (Marat, 1871)
Olivella minuta Link, 1807
Conidae
Conus pealii Green, 1830 (*C. jaspideus*?)
Pyramidellidae
Longchaeus suturalis (H.C. Lea, 1843)
Bullidae
Bulla striata Bruguière, 1792
Siphonariidae
Williamia krebsii (Mörch, 1877)
Ellobiidae
Tralia ovula (Bruguière, 1789)

CLASS BIVALVIA
Arcidae
Anadara notabilis (Röding, 1798)
Arca imbricata (Bruguière, 1789)
Barbatia cancellaria (Lamarck, 1819)
Mytilidae
Botula fusca (Gmelin, 1791)
Brachidontes exustus (Linnaeus, 1758)
Ostreidae
Dendrostrea frons (Linnaeus, 1758)
Limidae
Ctenoides scaber (Born, 1778)
Ctenoides mitis (Lamarck, 1807)
Pectinidae
Caribachlamys sentis (Reeve, 1853)
Euvola ziczac (Linnaeus, 1758)
Lyropecten nodosus (Linnaeus, 1758)
Spondylidae
Spondylus ictericus Reeve, 1856
Plicatulidae
Plicatula gibbosa Lamarck, 1801
Crassatellidae
Crassinella dupliniana (Dall, 1903)
Lucinidae
Anodontia alba Link, 1807 S
Divaricella quadrisulcata (d'Orbigny, 1842)
Cavilinga blanda (Dall & Simpson, 1901)
Ctena orbiculata (Montagu, 1808)
Parvilucina crenella (Dall, 1901)
Chamidae
Chama inezae (F. M. Bayer, 1943)
Chama radians Lamarck, 1819
Sportellidae
Basterotia quadrata (Hanley, 1843)
Planktomya henseni Simroth, 1896
Cardiidae
Americardia guppyi (Thiele, 1910)
Ctenocardia media (Linnaeus, 1758)
Veneridae
Globivenus rigida (Dilwyn, 1817)
Lirophora paphia (Linnaeus, 1767)
Periglypta listeri (Gray, 1838)
Pitar fulminatus (Menke, 1828)
Timoclea grus (Holmes, 1858)
Chione mazyckii Dall, 1902
Timoclea pygmaea (Lamarck, 1818)
Tivela abaconis Dall, 1902
Transennella gerrardi Abbott, 1958
Tellinidae
Angulus merus (Say, 1834)
Angulus paramerus (Boss, 1964)
Arcopagia fausta (Pulteney, 1799)
Tellinella listeri (Röding, 1798)
Tellina radiata Linnaeus, 1758
Semelidae
Ervilia nitens (Montagu, 1808)
Semele proficua (Pulterney, 1799)
Semelina nuculoides (Conrad, 1841)

CLASS POLYPLACOPHORA
Chitonidae
Acanthopleura granulata Gmelin, 1791 L
Chiton tuberculatus Linnaeus, 1758 B

CLASS SCAPHOPODA
Dentaliidae
Antalis ?antillarum (d'Orbigny, 1847) O

Discussion

It is apparent that Majors Bay supports a good species diversity, as revealed in the beach drift. Many species were found only as one shell or fragment(s). In 2010, living individuals of 15 species were observed: 14 species of intertidal gastropods and one intertidal chiton. In addition, numerous other species were found only as shells or fragments in the beach drift. During the 2010 visits, the most abundant shells in the drift were individual valves of the small bivalve *Cavilinga blanda*, which also occurs on Nevis, but is rare in the drift there. While snorkeling in the east end of the bay, shells of a number of species were either observed or collected, however all but three of the species had already been found in the beach drift. No live mollusks were observed while snorkeling. (In the tropics many species are inactive and hidden during the day; snorkeling or scuba at night using an underwater light would have been more productive.) There was no attempt to collect underwater sediment samples, which might have yielded additional micromollusks.

On April 27, 2010, one small (5.5 mm) white patelliform shell was found in the drift (Plate 1, Figures 1a & 1b). In 1a, the transparent apex (i.e. the protoconch) is visible at the top overlapping the margin. The dark spot less than one third of the shell's length below the apex is an incomplete drilling hole. The horse-shoe shaped muscle scar on the interior (not visible in Figure 1b) shows that the shell is that of a hipponicid, but it was an unfamiliar species to me. The shell is elevated, coarsely radially ribbed, and has a small knob-like apex that overhangs the posterior shell margin. This is clearly not *Hipponix antiquatus* or *H. subrufus*, both found in Majors Bay. It also does not resemble *H. incurvus* (Gmelin, 1791), previously known as *Capulus incurvus*. After some research, it became clear that the shell rather closely resembles two views of the holotype of the Brazilian species *Hipponix costellatus* Carpenter, 1856, as shown in Simone (2002, figs. 49 and 50). Judging by the scale bar, the holotype appears to be slightly smaller than the shell from Majors Bay. Two views of another similar shell are shown on the Natural History Museum of Rotterdam website as *Hipponix grayanus*, (no author listed) from Brazil; the common size is noted as 13 mm. Simone (2002) regards Western Atlantic records of *H. grayanus* as *H. costellatus*, and on Malacolog, *H. grayanus* auct. *non* Menke, 1853, is listed as a synonym of *H. costellatus*. According to Simone (2002), *H. costellatus* has a maximum reported size of 16 mm. Although *H. costellatus* is known primarily from Brazil, according to Rosenberg (2009), it has been recorded in the Lesser Antilles from the island of Saint Martin (approx. 100 km north-northwest of Majors Bay, St. Kitts) as *H. effodiens* Carpenter, 1856, which Rosenberg regards as a synonym. Finding *H. costellatus* in Majors Bay, St. Kitts seems to be only the second locality north of Brazil from which the species has been reported.

Two valves of *Crassinella dupliniana* were found. One 4 mm valve is shown in Plate 1, Figures 2a & 2b. According to Mikkelsen & Bieler (2007), this species is rare in the Florida Keys, and is listed as occurring in Florida, the Bahamas and the Gulf of Mexico; the authors compiled the range information in their book from published sources and from locality data in museum collections they had examined (Mikkelsen, personal communication, 2011). Rosenberg (2009) records this species from the same areas, and also from South Carolina. Eugene Coan (1984) mentions some specimens in the Natural History Museum of Los Angeles County (LACM 74-77) which are from the island of Jamaica, and which he tentatively assigned to *C. aduncata* Weisbord, 1964, a species which Rosenberg (2009) considers to be a synomym of *C. dupliniana*. However, other than that material, the current find in St. Kitts appears to be the first record of this species from the West Indies.

Two small upper valves of *Chama inezae*, the alabaster jewel box, were also found. Plate 1, Figure 3a shows the exterior of one valve (18.5 mm), which was found on April 19th. Figure 3b shows the 8.5 mm valve that was found on April 27th. *Chama inezae* is rarely encountered (personal communication Harry G. Lee, 2010). I have not found this species on Nevis. Bieler and Mikkelsen (2007) give the distribution of the species as Florida, West Indies, and the Caribbean coast of Central America.

Other interesting finds from the drift in Majors Bay were shells of two different small *Crepidula* species, called here "species A" and "species B", and shown in Plate 1, Figures 4 & 5. At Majors Bay I found several shells of species B and one shell of species A. On Nevis I have also (rarely) found shells in the drift of what appear to be the same two species; the shells I have found on both Nevis and St. Kitts have all been under 20 mm in length, usually less than 10 mm. In both species the apex is contiguous with the shell margin. The shells are usually thin and light. *Crepidula* species A has an all-white shell which is usually flat; Species B has an orange-brown shell which has no markings and is highly arched.

Previously (for example, in Warmke & Abbott, 1961) the white-shelled species would have been assigned to *Crepidula plana*, Say, 1822, and the orange-shelled species to *Crepidula convexa*, Say, 1822, but work on this genus by Collin (2000, 2002), and by Simone (2002), has demonstrated that there are numerous previously unrecognized *Crepidula* species in the Western Atlantic. Collin (2002) restricts *C. plana* to Georgia and north and comments that the true identity of the white-shelled *Crepidula* that occurs in the Caribbean Sea has not been determined. Collin (2002) also comments that *C. convexa* does not occur in the Caribbean Sea.

Determining recently clarified species of *Crepidula* such as *C. depressa* is not possible using only shell characters; living specimens are needed. Thus the identities of the *Crepidula* species that live in Majors Bay may remain undetermined unless live material can be found.

Two species were found alive in 2010 that had already been found as dead shells in 2009; *Lottia* "morphotype B" and *Tegula excavata*. Not counting these two, which were not new finds, species that were new to the list from Majors Bay in 2010 totaled 94, and included two additional classes. The number of new gastropod species (49) was more than twice as many as were found in 2009 (22). The number of new bivalves in 2010 (42) was three times that of 2009 (14). However, the overall time spent searching the bay in 2010 was almost 8 times the 40 minutes spent in 2009.

The combined species count for 2009 (1 visit) and 2010 (3 visits) is 138 species. Of these, 76 are gastropods, 59 bivalves, 2 chitons, and one scaphopod. Rosenberg (2009) lists 35 species for St. Kitts, only four of which were also found during my various searches at Majors Bay. Combining the Malacolog species list with the list in this paper gives a total of 169 species for the island of St. Kitts.

Conclusions

The 2010 searches of Majors Bay resulted in 94 species which were new to the St. Kitts list. These are a helpful addition to the faunal list for the island of St. Kitts. Fourteen intertidal species were observed live. Several of the beach drift finds are noteworthy records of unusual species. Surveying the fauna of this bay before it is developed for tourism provides data which may be useful for future comparisons.

Acknowledgments

Our friend the late Jim Johnson, biologist and conservationist from South Carolina and Nevis, had originally planned to meet us in St. Kitts when we arrived, but passed away the day before. He is much missed. I thank Quentin Henderson and Marlon Brando for driving us to Majors Bay on April 14th. Many thanks to Colin Redfern, Harry G. Lee and Captain Arthur Anslyn for very helpful input. I also thank my husband Ed Subitzky for financing my research, for encouraging me, and for fine-tuning the prose in all my papers. The information from Gary Rosenberg's database Malacolog 4.1.1 is provided with the permission of the ANSP. The plate was assembled with expert help from Ron Hartley.

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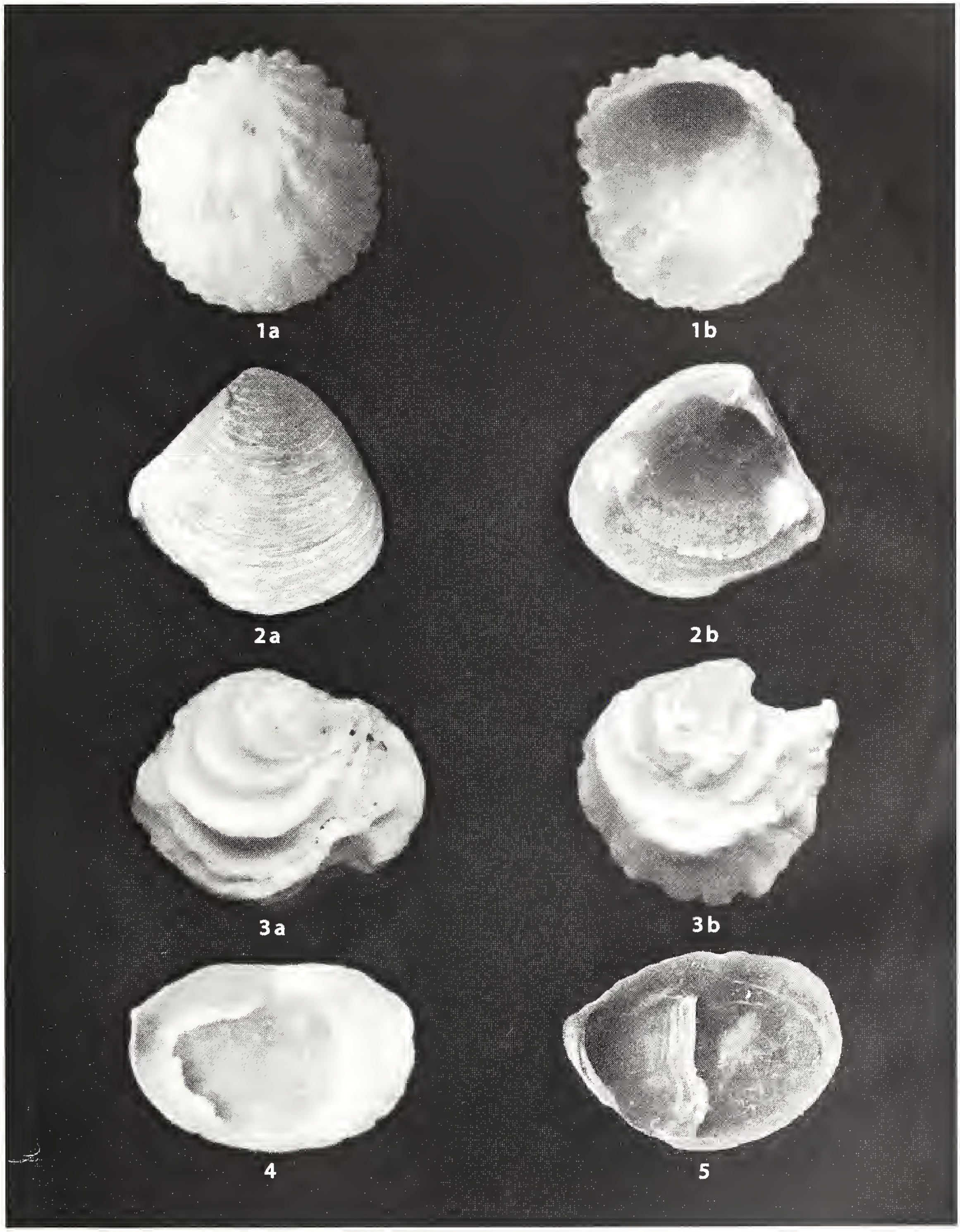
Plate 1, figs 1-5. Beach-drift shells from Majors Bay: **(1a & b)** Exterior and interior of *Hipponix costellatus*, 5.5 mm: transparent protoconch at the top of image, dark spot is incomplete drilling hole **(2a & b)** Exterior and interior of one valve of *Crassinella dupliniana*, 4 mm **(3a & b)** Exterior of two upper valves of *Chama inezae*, 18.5 mm and 8.5 mm **(4)** *Crepidula* sp. A, 11.5 mm **(5)** *Crepidula* sp. B, 13.5 mm. Images by Susan J. Hewitt.→

Plate 1



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THE FESTIVUS

A publication of the San Diego Shell Club

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PROGRAM

Come to the annual September Party
Home of Debbie and Larry Catarius
4173 Galt Street, San Diego, CA 92111
From 4-? PM (see page 92)

Party date: September 17, 2011

There is no regular meeting this month

CONTENTS

Club news 92
Sea star stomach uncovers geographical extension for *Parvanachis guerreroensis* Strong & Hertlein, 1937, and other goodies
EMILIO F. GARCÍA 93
An 18th century account of marine mollusks from the island of Nevis, Leeward Islands, West Indies
SUSAN J. HEWITT 95

CLUB NEWS

San Diego Shell Club Meeting Minutes
18 August 2011

The July meeting was called to order by President Jules Hertz at 7:45 PM. The minutes were accepted as published in *The Festivus* and there was no report from the treasurer who was unable to attend. Librarian Marilyn Goldammer encouraged members to make use of the Club's fine lending library and Vice President Bob Dees outlined the speakers for the next few months.

A sign-up sheet was passed for the September party to be held, once again, at the home of Debbie and Larry Catarius. Carole Hertz announced that there would be a book and reprint sale at the October meeting.

Bob Dees introduced the evening's speaker, member Paul Tuskes who gave a terrific presentation on the local (and almost local) mollusks of the families Trochidae, Turbinidae, Naticidae and Muricidae. He gave considerable information on morphology, habitat, feeding and predation, including views of the living animals of some of the species. His large, beautiful color plates clearly showed the differences in the species pictured in each of the families. It was a most enjoyable program and a pleasure to see our local mollusks as the stars of the show.

Following the program, Carole Hertz won the door prize. The refreshments for the social time were provided by Marty Schuler and Dave Waller and Paul Tuskes again provided specimens for the evening's silent auction which seems to be enjoyed by all.

Additions to the Roster

Lyons, William G., 4227 Porpoise Drive SE, St Petersburg, Florida 33705-4328.
E-mail: lyon@knology.net

Schramm, William, 24151 Las Naranjas Drive, Laguna Niguel, California 92677. Ph. 949-495-6971.
E-mail: bschramm@ivc.edu

The Annual September Party

The annual September Party will be on Saturday September 17th beginning at 4 PM until ? It will be held at the home and garden of Debbie and Larry Catarius at 4173 Galt Street, San Diego, 92111.

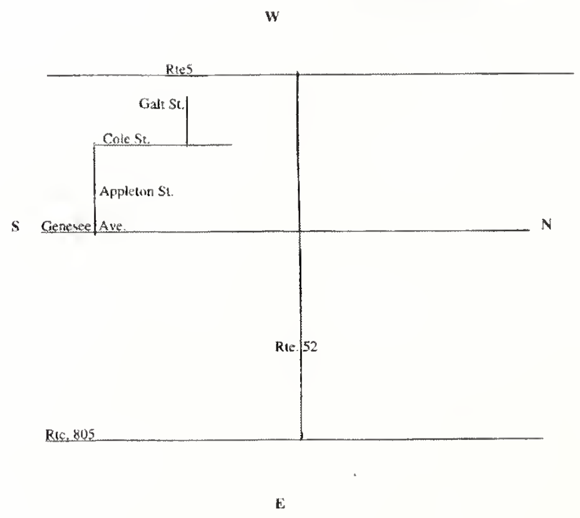
The party is always a potluck and if you were unable to attend the August meeting when the sign-up sheet was passed, and want to come to the party, call Carole Hertz (858-277-6259) and let her know whether you will bring a main dish, salad or dessert – all to serve 12. As always, the Club will supply soft drinks, beer, wine and coffee.

The September Party is a special event – a chance to just get together and have great food and visit with one another – and even talk shells!

So save the date and come to the party. See map below.

Take Hwy 5 or 805 to Hwy 52. Go to Genesee Ave. Go South on Genesee, up the hill to 1st right at top Go Right on Appleton to 1st stop sign, Right on Cole St. Take first left on Galt St. It's the third house on the left – 4173

Bring your potluck contribution and have a great time!!



SEA STAR STOMACH UNCOVERS GEOGRAPHICAL EXTENSION FOR *PARVANACHIS GUERREROENSIS* STRONG & HERTLEIN, 1937, AND OTHER GOODIES

EMILIO F. GARCÍA

115 Oak Crest Dr., Lafayette, LA 70503, USA
E-mail: Efg2112@louisiana.edu

Early in 1996 the late Trevor D. Roberts, of Coupeville Washington, joined by Shary Almasi, of Seattle, Washington, went to Panamá on a dredging expedition with the well-known Panamanian dealer James Ernest and his assistant Rafael Castillo. On the first of February, dredging off Punta Arenas, Veraguas state, in 80 ft. of water, they obtained an unidentified species of sea star, approximately five inches in diameter, which Rafael eventually dissected to search through the contents of its stomach for shells.

Rafael Castillo has been James Ernest's assistant for decades, and his curiosity for all things molluscan has led him to find unusual, at times undescribed, species of mollusks. For example, in 1998, on one of my visits to Panamá, Rafael showed me some small species he had collected in the Golfo de Chiriquí, among which was a new species of *Nassarius* (García, 2001). In the 1996 expedition Rafael gave his findings in the sea star stomach to Trevor Roberts. As Trevor eventually willed his collection to Shary Almasi, it is in her collection where the specimens addressed in this article now reside; and it was she, as curious a collector as Rafael, who asked me to try to identify the specimens. Shary is a member of the Pacific Northwest Shell Club, as was the indomitable Trevor.

The contents of the sea star stomach produced 17 specimens belonging to 16 species of 11 different families. All but two specimens were 7 mm or smaller; the *Turritella* was the largest at 13 mm. The specimens have been identified as follows (numbers refer to plate figures):

1- *Nucula exigua* Sowerby, 1833 - 3.5 mm
2- *Solariella triplostephanus* Dall, 1910 - 4 mm
3- *Turritella cf. mariana* Dall, 1908 - 13.0 mm
4- *Natica othello* Dall, 1908 - 3 mm
5- *Phos* sp. ?- 4.5 mm
6- *Parvanachis guerreroensis* Strong & Hertlein, 1937 - 4.5 mm
7- *Nassarius gemmulosus* (C. B. Adams, 1852) - 6.5 mm
8- *Nassariius* sp. - 5.0 mm
9- *Olivella morrisoni* Olsson, 1956 - 5.5 mm
10- *Terebra armillata* Hinds, 1844 - 7 mm
11- *Terebra guayaquilensis* (E.A.Smith, 1880) - 7 mm
12- *Leptadrillia* cf. *firmichorda* McLean & Poorman, 1971 - 7 mm
13- *Leptadrillia elissa* (Dall, 1919) - 7 mm
14- *Kurtziella*? sp. - 7 mm
15- *Turbonilla (Strioturbonilla)* sp. - 8 mm
16- *Turbonilla(Chemnitzia)* sp. - 6.0 mm

Of particular interest is *Parvanachis guerreroensis* Strong & Hertlein, 1937, since the southernmost locality for that species cited by Keen (1971: 332), and not challenged in Skoglund (2002: 130), seems to be the same as that reported by Strong & Hertlein (1937: 169): 16°38'N, 99°27'30"W, off Acapulco, Guerrero, México. The new record places *Parvanachis guerreroensis* in Panamá waters, approximately at 7°37'30"N, 8°1'50"W.

The other species of interest is No. 12, which I have tentatively identified as *Leptadrillia firmichorda* McLean & Poorman, 1971, in spite of the fact that the specimen is solid reddish-brown in coloration. Although the authors state that *Leptadrillia firmichorda* is dull-white with aperture and rib interspaces pink (1971: 93), the specimen, a sub-adult, otherwise conforms to the original description of the authors, including the protoconch (Figure 12).

I am most thankful to Shary Almasi for allowing me to study this material.

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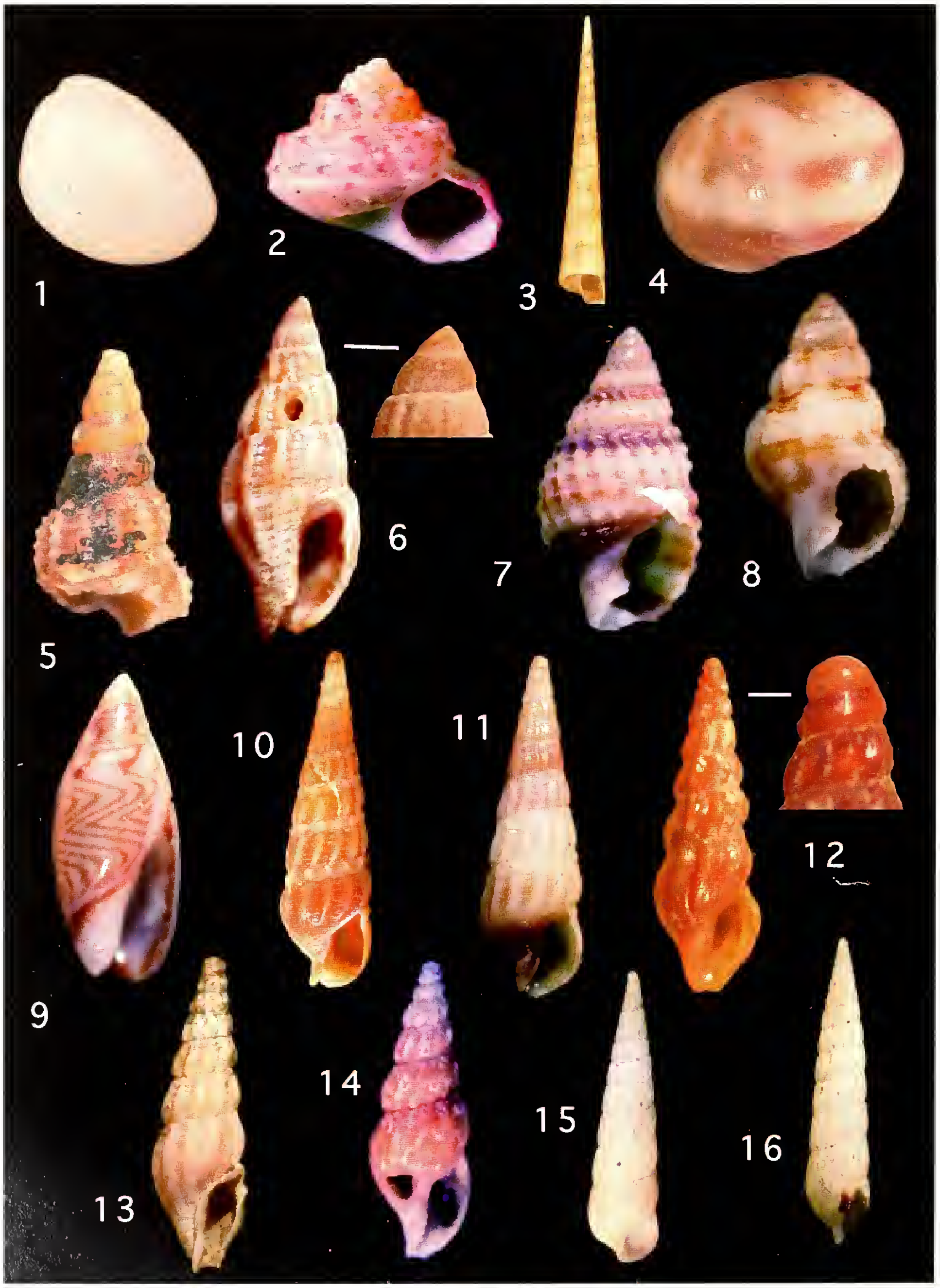

AN 18th CENTURY ACCOUNT OF MARINE MOLLUSKS FROM THE ISLAND OF NEVIS, LEEWARD ISLANDS, WEST INDIES

SUSAN J. HEWITT*

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Introduction

I have been researching the marine mollusk fauna of the island of Nevis, Leeward Islands, West Indies, since 1997, more intensively so since the year 2000. Almost no scientific research had been carried out on Nevis prior to my efforts; indeed, in reference to Nevis and its sister island St. Kitts, Warmke & Abbott (1961) stated, "These two islands...are conchologically poorly known and are greatly in need of investigation." Thus I resigned myself to an almost total lack of early information on the fauna of the island of Nevis.

However, over the years I have been able to find two unexpected sources of information about the fauna of Nevis in earlier times, information that did not come from the scientific literature. One source was a book written by a minister (Smith, 1745), and the other, which will be described in another short paper, was an ancient archeological site. The book includes some commentary on a shell collection made *circa* 1720 on Nevis. The written descriptions are detailed enough that they permit identification of several of the species, and the material itself may still exist in a museum in England.

In 2003 I was told by the late Joan Robinson of the Nevis Historical and Conservation Society (NHCS) about a work published in the 1700s that contained information about Nevis natural history. The NHCS had a copy of the book in their collection, and in New York I was able to study another copy in the library of the AMNH (Figure 1). As I went through the book, I found there were several mentions of marine mollusks from Nevis. The quotes used in this paper are taken from the book's unnumbered dedication, and from pages 1–5, 9 and 293.

The author was from England. He was a Church of England cleric named Reverend William Smith, who spent, in his words, "five happy years" as the Rector of

A
NATURAL HISTORY
OF
NEVIS,
And the reſt of the
Engliſh Leeward *Charibee* Iſlands
IN
AMERICA.
With many other Obſervations on
NATURE and ART;
Particularly, An Introduction to
The Art of Decyphering.
IN
Eleven Letters from the Rev^d Mr. SMITH, ſometime Rector of St. *John*'s at NEVIS, and now Rector of St. *Mary*'s in BEDFORD; to the Rev^d Mr. MASON, B.D. *Woodwardian* Profeſſor, and Fellow of *Trinity-College*, in *Cambridge*.

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Figure 1. The title page of Smith's book, 1745.

St. John's Parish, now St. John Figtree Parish, in the southeastern part of Nevis. While he was living on Nevis, Smith made some notes, or as he says, "kept a Book of Remarks upon what I saw most observable," but it appears that his notebook has not survived. Smith was certainly on Nevis in 1720, and it seems that he was on the island from 1718 to 1722 or thereabouts. When he returned to England, Smith became Rector of St. Mary's Church in Bedford, but neither the Nevis church nor the English church have records that might enable me to be certain which years Smith was on Nevis.

Smith says he "collected many beautiful Sea Shells," and comments, "These shells are found upon that part of the Coast of *Nevis* where the sea is most subject to Rocks on the Western side." The west side of Nevis is mostly sandy shore with occasional rocky areas, and those spots are indeed the best places for finding beach drift shells. Smith also points out that, "in our Hurricane Months, viz. *July* , *August* and *September*...Shells are cast up in considerable quantities on the rocky shore," which is certainly true. He then imagines that it is the sun, and not abrasion that makes beach drift shells so clean: "That they are so cast up is certain: but then let me tell you, that their Colours are no ways bright and beautiful, till they have lain upon the Sea-shore for some time, to dry and polish by the Sun's hot Rays that will soon scorch off such Moss and Soil as may stick about them."

When Smith traveled back to England he brought with him the material he had found on Nevis, not only the marine mollusk shells, but also some sea urchin tests and gorgonian skeletons. He eventually gave the material to "Dr. Woodward's Repository of Fossils" (now known as the Sedgwick Museum of Earth Sciences) at Cambridge University, but he did not make the donation until, as he says, "about nine years after" his return.

Smith contacted the Reverend Charles Mason, professor of geology at Cambridge University. Mason requested that Smith send him a letter explaining the material. Smith ended up writing 11 undated letters recounting his experiences on Nevis, his visits to other Leeward Islands, and various unrelated topics. In 1745 the letters were published as the book I examined. It has a 70-word title, which is often shortened to "A Natural History of Nevis, and the Rest of the English Leeward Charibee Islands in America. With many other Observations on Nature and Art."

In his first letter to Mason, Smith says, "had I imagined (when at *Nevis*) my Shells would ever have been lodged in so honorable a place, the Collection should have been larger if not more curious." However, Smith had donated his collection to a museum of fossils and rocks, and the material he gave was all Recent. Presumably because of this, the material was never accessioned or catalogued. I made e-mail and phone inquiries to the Sedgwick Museum curatorial staff in 2004, 2005 and 2006. The responses I received suggested that the survival of Smith's material to the present day is quite probable, but the staff was not able to locate it during a brief search.

Smith's letters were written in the pre-Linnaean era. He was not a conchologist, but nonetheless he was a keen observer, a typical gentleman of the Age of Enlightenment: educated, intelligent, with a sense of humor, a lively curiosity and a robust imagination not unlike that of a scientist. His letters touch on many different aspects of the fauna and flora of Nevis, terrestrial and marine, and he mentions several kinds of marine mollusks and other marine invertebrates.

Some of Smith's descriptions are cursory, others have more information. In some cases the descriptions are detailed enough that one can assign a family, and occasionally even genus and species, as shown in the following list. It contains quotes from Smith's book, and the headings are my attempted identifications.

Gastropods

Fissurellidae

Fissurella nimbosa (Linnaeus, 1758)

On pages five and six, Smith says, "You will find in my Collection at least a dozen Shells that are brown on the outside and of a palish green on the inside, called *Patellae*. They rise gradually from an oval base in shape of a Pyramid having generally speaking a little oblong hole at the top." *Fissurella nimbosa* is both the largest species of fissurellid on Nevis and the only one that closely fits Smith's description. He also reported that these shells were "gathered in the year of our Lord 1720" and that they were called "Nipple Shells" because they are "a sovereign remedy for the sore Nipple of a lying-in Woman's Breast, being applied thereto."

Trochidae

Cittarium pica (Linnaeus, 1758)

On page 2, Smith says that most of the mollusks on Nevis do not have names because "we seldom or never eat of them, unless it be a large particular sort of Wilk." I am certain that Smith was referring here to the West Indian top snail, *Cittarium pica*, which is still known by

the name "wilks" (now acting as both a singular and plural noun). To this day, wilks remain a popular food item on Nevis. Smith also says that the shells are "finely polished and made into snuff boxes (very commonly) at London." The shells of *Cittarium pica* have a thick inner layer of nacre, and polish well.

On the same page is a footnote: "*Note*, That a Wilk Fish looks and eats exactly like our English Perriwinkle." By "looks and eats" Smith most likely meant that the meat of the wilk appears, taste, and has a texture like that of the common periwinkle *Littorina littorea* (Linnaeus, 1758), which is still served boiled as a seaside snack in the British Isles. The external soft parts in both species usually have a dark exterior and a light undersurface to the foot. I suspect Smith may also have meant that, like the periwinkle, *Cittarium pica* has a round corneous operculum which has to be discarded before the meat is consumed.

Naticidae

On page five, Smith makes reference to what may have been evidence of naticid predation when he says that some shells have "little round holes that seem as it were artfully drilled." It is conceivable that the drill holes were produced by muricids instead of naticids, but in my experience, naticid drilling holes are far more common than muricid drillings in beach drift shells collected on the western coast of Nevis.

Vermetidae

On page 5, Smith makes a brief mention of "Sea-worms (the Shells of some of which I sent you.)" Although the calcareous tubes of serpulid tube worms do occasionally wash up in the beach drift on Nevis, the shells of vermetid worm snails are far more common, so it seems likely that this is what Smith had in his collection.

Bivalves

Chamidae

On page 293, Smith explains in another letter to Mason that "the cluster of roundish Shells about as big as my fist, which are cemented and grown together, was picked up among the Rocks and Sand at *Black Rock Point*, that is to say about half way between the Pond and Charles Town, at Nevis." Smith calls this "Barnacle Shells...washed off some Rock in the Sea, and thrown ashore in a Storm or Hurricane." However, other than the barnacles that live on whales and turtles, there appear to be no large acorn barnacle species living in the Leeward Islands, so I suspect that this was a group of lower valves of *Chama congregata* Conrad, 1833. This small species of *Chama* commonly grows in cemented clusters which sometimes wash up on beaches.

Cardiidae

On page 9, Smith says, "I had almost forgotten to mention the Variety of Cockle-shells I sent, that resemble our English ones in Shape, though infinitely surpassing them in beauteous Colours and some of which are on the outside far rougher than a Nutmeg-grater, but shine like the best polished Marble." Here he is contrasting the white shell of the European cockle *Cerastoderma edule* (Linnaeus, 1758), with the colorful Caribbean species. I am certain he had in his collection *Trachycardium isocardia* (Linnaeus, 1758); the shell of this species has an outer surface covered in sharp scales which are indeed reminiscent of a nutmeg grater, and an inner surface which is glossy and somewhat translucent with a salmon-colored glow. Smith probably also found shells of *Trachycardium muricatum* (Linnaeus, 1758) and possibly even *Acrosterigma magnum* (Linnaeus, 1758). All three species occur on Nevis today.

Donacidae

On page two there is a vivid description of *Donax denticulatus* (Linnaeus, 1758). Smith records it as a food item having the local name "cockle". Referring to the collection he donated, Smith explains to Mason, "You have at least a dozen of the Shells (no way shaped like our English Cockles) that are small and of a triangular Form, but not equilaterally so, the two Sides of them being each of them full as long again as the short Side; all the three Angles are rounded off or blunted; they are of a white shining Colour like well polished white Marble, and generally speaking streaked downwards very regularly with beautiful Red or Blue Veins."

Smith goes on to explain how the *Donax* were gathered: "A Negro Man goes in at one of our sandy Bays up to his knees, where stooping down he fills a Basket with Sand from the bottom, which Basket he dips so often in the Water, as till the Sand being washed clean away leaves the Cockles behind."

These small bivalves are still known as "cockles," and within living memory they were gathered for food, primarily as a special Easter dish. In recent years this species seems to be abundant in only one place on Nevis, Cades Bay.

Somewhat surprisingly, Smith fails to mention any of the more spectacular species on Nevis, including the Queen Conch, *Eustrombus gigas* (Linnaeus, 1758)

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which is large and beautiful, and would have been an abundant species 300 years ago. Perhaps he did not have one of these in his collection, or could not easily carry large and heavy shells back to England. What's more, his letters were recollections (sometimes rather rambling) that were composed not while he was still on Nevis, but nine or more years after his return, with some help from his notebook. Smith himself says, "my Book of Remarks might not be free from Errours; and...in diverse Articles I was forced to trust solely to memory." On the same page he requests that the "worthy gentlemen of Nevis" will "rectify those Errours; as well as point out such curious things as may have escaped my memory or notice; indeed I lay hold of this opportunity to request the same of all others who discover faults in them."

I myself would be happy to rectify some of Smith's errors, and also to correct or confirm my attempted identifications, if his shell collection is ever successfully located within the Sedgwick Museum storage. Even though many of the identifications I present here are tentative, not definitive, it is still interesting to be able to perceive something of the marine mollusk fauna of Nevis as it was during the early part of the 1700s, based on information from an unexpected source.

Acknowledgments

Many thanks to the Nevis Historical and Conservation Society on Nevis, to the curatorial staff of the Sedgwick Museum of Earth Sciences in Cambridge, England and to the library staff of the American Museum of Natural History in New York.

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PROGRAM

Effect of Climate Change and Fishing on Molluscan Biodiversity

Kaustov Roy is a professor at UCSD whose work in his lab is focused on a) the processes that can shape large scale biodiversity gradients in the ocean and b) how marine species and communities respond to climate change and other anthropogenic impact and the long term consequences of such responses.

(This program was originally scheduled for May, but due to unforseen problems, it was postponed until this month.)

GIANT BOOK, MAGAZINE AND REPRINT SALE

Program date: October 20, 2011

CONTENTS

Club news 100
An ancient archeological marine mollusk assemblage from the island of Nevis, Leeward Islands, West Indies
SUSAN J. HEWITT 101
Book News: *A Conchological Iconography. The Family Pectinidae* by Raines & Poppe, 2006
CAROLE M. HERTZ & BARBARA W. MYERS (reviewers) 105

CLUB NEWS

The Annual September Party
September 17th

The annual September Party on Saturday, September 17th, was held, once again, at the home and garden of Debbie and Larry Catarius. Debbie and Larry have added a "sun room" and expanded their patio and garden areas. Their home and garden gets more lovely every year. The 25 or so of us in attendance had a great time. The weather perked up and it was a terrific get-together.

The party, always a potluck, with special food – some delicious entrees – tamales, chile, shrimp fried rice, fried shrimp and salads – cucumber and tomato, wonderful mixed greens with nuts, and one special fume salad. And then there were the desserts – berry pie, pineapple upside-down cake and a sinful chocolate creation. There was wine, beer and mixed soft drinks and we all ate and ate and conversations with friends never lagged.

The September Party is a special event – a chance to just get together and have great food and visit with one another – and even talk shells! Our big thank you to Debbie and Larry for again hosting this annual event.

Giant Book, Magazine and Reprint Sale

This is the Club's annual sale of books, serials and reprints. It's getting close to holiday shopping time and this is an opportunity to acquire some publications for gifts as well as for your own library. The prices, are always phenomenally low to encourage purchases.

All proceeds from the sale are targeted to future purchases for the Club's library. Buying time will be before the business meeting and program and during the social time after.

The Club's Annual Christmas Dinner Party
Saturday December 3rd

It seems really early to write about this, but there are only two more meetings before it's time for the Club's annual Christmas Dinner party on Saturday evening, December 3rd. Once again it will be held at *The Butcher Shop* at 5255 Kearny Villa Road in Kearny Mesa (maps can be acquired by going on the restaurant website). The festivities will begin at 6 PM with no-host cocktails, dinner to be served promptly at 7 PM.

The menu for the evening is: mixed greens salad with choices of dressing and rolls and butter. Entree choices are 8 oz. prime rib of beef or fillet of salmon, both served with potatoes and vegetables (a vegetarian plate is available also). Dessert will be white chocolate raspberry cheesecake and coffee or tea. The Club will provide dinner wines as always. The cost of the entire evening is $30 per person.

Our speaker for the evening needs no introduction to our members. Bob Yin, author, noted underwater photographer and Club member, always gives a terrific presentation. His topic will be announced later.

As always, there will be the traditional shell gift exchange. Bring a gift-wrapped shell(s) or shell related item. Put the complete data (locality, collector, date etc.) inside the package only. On the outside attach only very general locality i.e. eastern Pacific, Caribbean, Atlantic. This is a favorite part of the evening and the more people who participate, the more fun the evening will be.

Reservations for this event must be received by Monday,. November 28th. Please make your checks payable to The San Diego Shell Club. If you would like to include your 2012 membership with the same check, that will be fine. Just add the $20 for the membership.

AN ANCIENT ARCHEOLOGICAL MARINE MOLLUSK ASSEMBLAGE FROM THE ISLAND OF NEVIS, LEEWARD ISLANDS, WEST INDIES

SUSAN J. HEWITT*

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Introduction

I have been studying the marine mollusks of the island of Nevis, Leeward Islands, West Indies, on annual visits since 1997, basing my investigations primarily on beach drift shells. As almost no relevant papers had been published previous to my efforts, I had resigned myself to an almost total lack of prior information on the mollusk fauna of the island. However, I was able to gather some data from an unexpected source: a prehistoric shell heap. There are numerous prehistoric sites on Nevis; a full discussion can be found in a monograph by Wilson (2006), based on fieldwork he and his team carried out from 1984 to 1995. Wilson's book (which includes an analysis of the floral and faunal remains of all the sites) had not yet been published when I carried out the fieldwork described in this paper.

In coastal regions during ancient times, marine mollusks were an important food resource for settlers. Shell heaps (one form of food trash deposit or "kitchen midden") sometimes remain to the present day as a visible record of what was consumed. The first settlement of Nevis took place when people from early Amerindian cultures migrated north from what is now Venezuela, traveling from one small island to another along the Lesser Antilles. The early Amerindians created settlements on all of the habitable islands.

In 2005, the late Jim Johnson told me about an ancient archeological site on Nevis known as "Hichmans Shell Heap." I decided to visit it, in order to see which species had been present during the time it was being formed. On 3 May 2006 I hiked to the shell heap, with Nichole Johnson and Dr. Thomas Last leading the way. The heap is in a remote part of the windward (eastern) coast; the site is only rarely visited by humans, its main visitors being free-roaming goats and feral donkeys.

After the site was abandoned, it eventually became buried in soil. However there is considerable erosion in this part of the coastal plain. There is now no vegetation in the immediate area, and the land is repeatedly washed by rain and runoff (Text figure 1). Some of the material

Text figure 1: May,7 2006, view inland from the western edge of the heap, Nicole Johnson and Dr. Thomas Last searching. Photo: Susan J. Hewitt.

that was previously buried has weathered and lies loose on the surface or partially embedded in the clay that forms the matrix of the site (Text figure 2).

Although the word "heap" suggests a raised formation, Hichmans Shell Heap is not appreciably elevated above the surrounding land. The site is nonetheless easy to spot because some parts have a high concentration of the whitened remains of shells, including whole, broken and fragmented shells. The heap is visible on the satellite images of Google Earth (2009); the densest parts show as three off-white smears by the coastline.

The area occupied by the heap is roughly oval in shape, approximately 55 m long by 15 m wide, with the densest areas of shell debris occupying about half that extent; see the map in Wilson (2006:30). In the account of his investigation, Wilson explains that when his team dug excavation pits they discovered that the layer of

shell material in the heap is quite shallow, ranging from less than 10 cm deep to a little more than 25 cm (Wilson (2006:34). He describes the site as Archaic and pre-ceramic (too early for pottery), stating that Hichmans Shell Heap appears to date from 790 to 520 BC, more than 2,500 years before the present. It is considered to be the oldest settlement site on Nevis, and is the only known prehistoric shell heap on the island.

In 2006, the eastern edges of the heap were 7 to 15 meters inland from the edge of a 3 m cliff, below which is a beach composed of rocks and cobbles. I examined the clifftops to see if any beach drift shells might have been thrown up that high during storms, but I did not find any. Kozuch & Wing *in* Wilson (2006:181) raise the possibility of land hermit crabs, *Coenobita clypeatus* (Fabricius, 1787), switching shells on the heap, but like them I saw no wear and tear on any of the shells (such as a notch on the columella) that would be evidence of crab use. I believe it is reasonable to assume that all the shells on the heap are indeed ancient, with one exception to be described below.

During my search of the heap, to avoid disturbing the site, I examined and identified only shells that were already weathered out on the surface. On the other hand, as archeologists, Wilson and his team (2006:34) dug 10 pits that were each 1 m square and penetrated into the subsoil below the shells. They then sifted and analyzed the resulting material. Kozuch & Wing *in* Wilson (2006:172-173) identified and listed the animal taxa that were found, including the mollusk shells. Kozuch and Wing also compiled a master list of the taxa of animals that were discovered in all the prehistoric sites on Nevis (ibid:154-161) or on any of the individual lists for the prehistoric Nevis sites.

Results

The following is a list of taxa of marine mollusk shells I observed on Hichmans Shell Heap, 3 May 2006, at 17° 08.05' N and 62° 32.30' W, and 6 m above sea level. Families are listed in taxonomic order; gastropods following Bouchet & Rocrois (2005) and bivalves following Mikkelsen & Bieler (2007). Binomial epithets are taken from Rosenberg (2009).

Plain text = species also recorded from the heap by Kozuch & Wing in Wilson (2006:172).

Boldface = species not previously recorded from this site.

* = species not recorded in the master list.

Text figure 2: The surface of the heap showing two shells of *Cittarium pica*, a spire of *Eustrombus gigas*, shell fragments, pieces of volcanic rock, and feral donkey dung. Photo: Susan J. Hewitt.

Gastropoda
Trochidae
Cittarium pica (Linnaeus, 1758)
Turbinidae
***Lithopoma tuber* (Lightfoot, 1786)**
***Lithopoma caelatum* (Gmelin, 1791)** (opercula only)
Neritidae
***Nerita tessellata* Gmelin, 1791**
*** *Nerita fulgurans* Gmelin, 1791**
Strombidae
Eustrombus gigas (Linnaeus, 1758)
***Aliger costatus* (Gmelin, 1791)**
Tonnidae
***Cypraeacassis testiculus* (Linnaeus, 1758)**
Muricidae
***Chicoreus brevifrons* (Lamarck, 1822)**
***Chicoreus pomum* (Gmelin, 1791)**
***Thais deltoidea* (Lamarck, 1822)**
Turbinellidae
****Vasum muricatum* Born, 1778**
Bivalvia
Arcidae
Arca zebra (Swainson, 1833)
***Anadara notabilis* (Röding, 1798)**
Plicatulidae
***Plicatula gibbosa* Lamarck, 1801**
Lucinidae
***Codakia orbicularis* (Linnaeus, 1758)**
Chamidae
***Chama macerophylla* Gmelin, 1791**
*** *Chama congregata* Conrad, 1833**
Polyplacophora
Chitonidae
Chiton sp.

I was surprised to see that three full-grown individuals of the large periwinkle or littorinid *Cenchritis muricata* (Linnaeus, 1758) were living on the ancient shell debris. This species inhabits the supralittoral fringe, living on hard surfaces meters above the high water mark, even well above the splash zone. Nonetheless, I was taken aback to find these "marine" snails as far as 20 m inland from the cliff edge. The area is subject to strong winds; presumably fine saltwater spray reaches inland that far.

The meat of these large sea snails was not the only part that had been used. Even to my inexpert eye it was clear that some of the ancient shells of *E. gigas* had been worked into shell blades.

In all I found the remains of 19 taxa of marine mollusks. *Cittarium pica, Eustrombus gigas* and *Arca zebra* were by far the three most abundant species on the heap and so were apparently an important food source. In the case of *Arca zebra*, the majority of valves were larger than those I usually find on Nevis. The ancient shells of *Eustrombus gigas* were not exceptionally large, but they had apertural lips of up to 30 mm in thickness, a sign that the animals had lived numerous years as adults. Nevis has seen over-harvesting of *E. gigas* in recent decades, and it is now rare to find an individual that has reached such a mature age.

In addition to the three main species, I found 16 other taxa represented on the heap. Whether these were also eaten, were incidental catch, or served some other purpose, is not clear. It seems odd for example that *Lithopoma caelatum* was found not as whole shells, nor even as fragments, but only as three opercula.

The faunal composition of my list seems to correspond well with the modern fauna of Nevis, with a minor exception: *Nerita fulgurans* was present on the heap as several broken shells, although this species seems to be rare on Nevis now. Many of the species in my list suggest rocky habitat; other species including the two strombids, the *Anadara*, and the *Codakia*, suggest a sandy habitat with seagrass. However, today on this part of the Atlantic coast there is very little sand and no seagrass because of the destruction of coral reefs that previously protected the coastline.

There were two very small shell piles 185m north-northeast of Hichmans Shell Heap, each about 1.5 m across, which were partially concealed by grasses and other vegetation. These piles appeared to consist entirely of thousands of very small shells. I was able to see numerous *Supplanaxis nucleus* (Bruguière, 1789), *Nerita tessellata* Gmelin, 1791 and one *Rhombinella laevigata* (Linnaeus, 1758). These snails are so small that it is hard to imagine them as a food source, so perhaps they were collected for some other reason.

Comparison with Wilson's results

While I list 19 marine mollusk taxa, Kozuch & Wing *in* Wilson (2006:172), list 18. (I have not included one land snail and indeterminate gastropod remains in the latter number.) Although our numeric totals are similar, the two lists show strikingly few species in common. We both observed the three most abundant species: *Cittarium pica, Eustrombus gigas* and *Arca zebra*. Kozuch and Wing listed *Nerita* spp., *Chama* spp. and *Anadara* sp., whereas I was able to identify *Nerita tessellata* and *Nerita fulgurans; Chama macerophylla* and *Chama congregata; and Anadara notabilis*. We each listed an unidentified *Chiton* sp. plate.

In addition to the species just mentioned, I found another 10 species not found by the other team, and they found 11 taxa that I did not find. This significant lack of overlap between their list and my list seems to suggest that a number of additional species remain to be discovered.

Kozuch & Wing *in* Wilson (2006:154–164) combined the faunal taxa from all of the prehistoric sites on Nevis into a master list, which contains 45 taxa of marine gastropods, 22 marine bivalves, and 5 chitons. Three of the species I found on the shell heap are not on the master list: *Nerita fulgurans, Vasum muricatum* and *Chama congregata*. *Anadara notabilis* was omitted from the master list, but is on the individual list for the Sulphur Ghaut site (Kozuch & Wing *in* Wilson (2006:166)).

One wonders whether *N. fulgurans* could have been misidentified as the similar *N. tessellata*, and likewise whether *A. notabilis* could have been thought to be *A. transversa* (Say, 1822).

Of the marine mollusk taxa on the archeological master list, I have found all but four as part of the living fauna of Nevis. The four I have not encountered are: *Anadara transversa, Euvola laurentii* (Gmelin, 1791), *Ostreola equestris* (Say, 1834), and *Stramonita haemastoma* (Linnaeus, 1767). I have not personally found *Phacoides pectinatus* (Gmelin, 1791) but one valve was reported to me as having been observed on Pinneys Beach, Nevis in the 1990s. Before studying Redfern (2001: pl. 42 #383C, p. 90), I thought I had found juvenile shells of *Stramonita haemastoma*, but now I realize they are almost certainly just the smooth

form of *Stramonita rustica* (Lamarck, 1822). As for *Euvola laurentii* and *Ostreola equestris*, whether these two species are still living on Nevis remains to be seen.

Another species on the archeological master list is the foam oyster *Hyotissa mcgintyi* (Harry, 1985) listed there as *Pycnodonte hyotis*, and found in the Sulphur Ghaut site (Kozuch & Wing *in* Wilson (2006:163). When I found fresh material of this species in Nevis and St. Eustatius, I reported it (Hewitt, 2010) as a new record for the Lesser Antilles, unaware that this unusual bivalve had already been reported as a prehistoric archeological record.

Conclusions

The species of ancient shells I found on Hichmans Shell Heap brings the total number of marine mollusk taxa reported there from 18 to 29. The marine mollusk fauna reported from Nevis ancient archeological sites does not appreciably differ from the living fauna. Nonetheless the material on the shell heap is an interesting and unanticipated window into the marine mollusk fauna of Nevis as it was over 2,500 years ago.

Acknowledgments

Thanks to the late Jim Johnson of Nevis. Thanks also to Nicole Johnson of Nevis, and Dr. Thomas Last of St. Kitts, who helped me search the heap.

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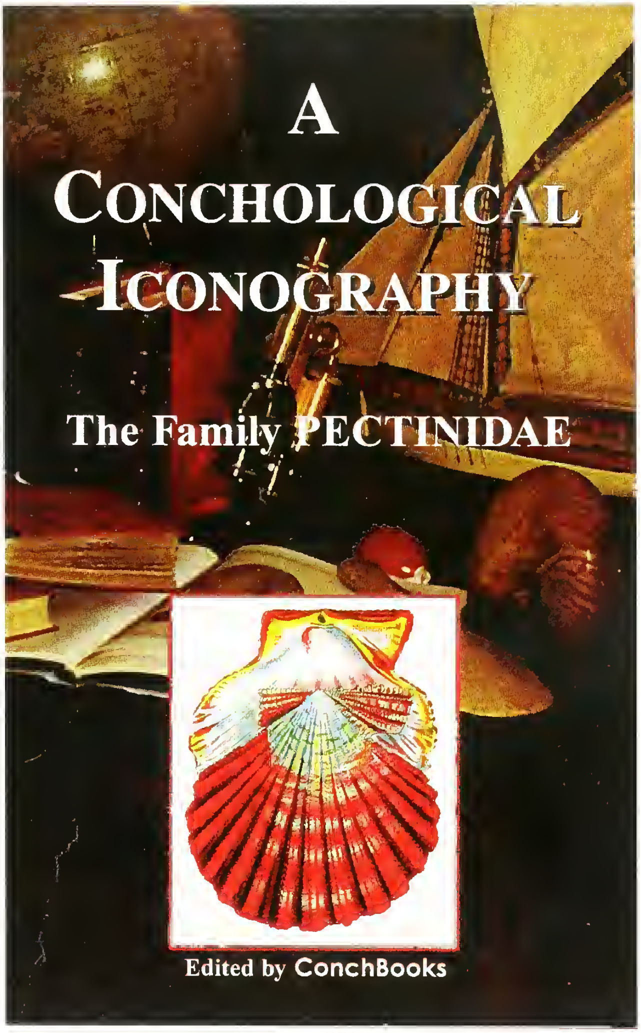
BOOK NEWS

A Conchological Iconography. The Family Pectinidae (2 parts)
By: Bret K. Raines and Guido T. Poppe. 2006.
Publisher: ConchBooks.
Hardcovered in 4-ring-binder format with heavy-weight cardstock pages.
Part 1-- text, 242 maps & b&w pls. 402 pp.; Part 2 – 320 color pls.
Price: $281.00 approximately.



The two parts of ***A Conchological Iconography of the Family Pectinidae*** by Raines & Poppe form a beautiful set, each part in 4-ring binder format, one of full-color plates and the other text, maps and b&w plates of the Recent species. Unfortunately, the heavy volumes (one of 402 pp. [text] and the other of 320 full-page color plates) do not lend themselves to easy manipulation. The rings, constructed in the shape of a backward capital D do not stay aligned requiring the user to wrestle with the heavy-weight pages.

In the beginning of Part 1, the Table of Contents for the Pectinidae Rafinesque, 1815 (not Wilkes, 1810) lists the subfamilies with their genera, followed by six pages (8-13) of general information on the pectinids such as systematic position, general morphology, history, glossary, selected terms, general pectinid biology, bibliography and index. A paragraph entitled Overview of the Family and its Genera cites some of the recent research done on the family and lists the systematic arrangement adopted in the book. The authors did not include the Propeamussidae, Abbott,1954, a family separate from the Pectinidae; although several genera now assigned to Propeamussidae i.e. *Amusium, Cyclopecten, Propeamussium* and *Parvamusium* are found in the Pectinidae here.

The format in Part 1 usually places the species information with map on the left page and the unnumbered b&w plate referring to the species on the facing page. This is very convenient. The species in Part 1 are listed alphabetically under the appropriate genera, with figure references to the color plates in Part 2, not to the b&w figures. Sometimes the fine

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quality b&w and color illustrations for each species are disappointing in that, in some cases, only one exterior view of a valve is shown, and/or in others no interior views or exterior views of both valves of a species.

In using these volumes extensively while curating the Pectinoidea in the Marine Invertebrate Department of the San Diego Natural History Museum, we found other confusions with the plates. As an example, in studying *Euvola vogdesi*, we noted (in the text section) that the color illustrations were on Plate 116. However, the plate was of *E. ravenelli* and showed four figures of the left valve. By paging through the illustrations of *Euvola*, we found *E. vogdesi* on Plate 117, figures 2-4 (again all left valves), with *E. stillmani* as figure 1 – besides *stillmani* being on Plate 112 as figures 1a,b and 3a,b.

It was difficult for us to accept some generic placements in Raines & Poppe because there is no descriptive information on the genera except for the listing of the type species and occasional brief remarks.

As Raines and Poppe explain in an excerpt from the "Overview of the Family and its Genera [p. 13]",

> "With the recent increase in the amount of attention being focused on the family **Pectinidae**, the systematic arrangement has been in a constant state of change. There is much controversy among malacologists regarding species validity and/or placement within the appropriate genera ... Since relationships at species level are still not completely understood, most species are listed in alphabetical order within their respective genus. ..."

We discovered that there are over ten genera, each with only one species. Without generic descriptive information, it is usually not possible to decide with confidence the validity of the genus or the placement of its species, except in the few instances when the exterior appearance seems sufficiently different to understand a change in genus such as in *Pedum*.

The placement of synonymies in the book is complicated. Instead of their inclusion with the treatment of each species, they are placed in the "Systematic Arrangement [pp. 15-34]", the "Alphabetical listing of Valid Taxa [pp. 36-39]", the "Non Valid Taxa," a cumbersome list [pp. 341-356] and in the Index [pp. 384-402]. It would have been so much simpler for the user to have the synonymy together with each species description – and it would have saved numerous pages.

The Index is complete including synonymies, but unwieldy because of the use of different font styles to indicate different page numbers for color plates, b&w plates, text references and main text references. Often, too, the regular font and the italic font look very much alike! No page numbers are listed for the beginnings of generic sections.

Despite the difficulties described above, there is no doubt that this is a beautiful set on the Pectinidae which will be helpful in identifying pectinid species worldwide. The color plates in Part 2 are extravagantly beautiful, and it is the first recent comprehensive book on the Pectinidae of the world, other than Rombouts (1991), that these reviewers have seen.

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THE FESTIVUS

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PROGRAM

Greg Rouse, Professor of Marine Biology and Curator of SIO Benthic Invertebrate Collection at Scripps Institution of Oceanography, who has been on a research voyage off Antarctica from September to early November will present an exciting program on this research.

Meeting date: November 17, 2011

CONTENTS

Club news 108
Cuming's eastern Pacific localities
EUGENE V. COAN 109
44th annual conference of the Western Society of Malacologists meeting jointly with the 12th biannual meeting of the sociedad Mexicana de Malacología
NORA FOSTER 113
Selected index for 2011
JULES HERTZ (preparer) 115

CLUB NEWS

San Diego Shell Club Minutes
20 October 2011

The meeting was called to order at 7:40 P.M. by Jules Hertz, President. The previous minutes were accepted as published. Silvana Vollero gave the treasurer's report. Jules announced the board's slate of Shell Club officers for 2012. They are: President Bob Dees, Vice President David Waller, Treasurer Silvana Vollero, Corresponding Secretary Marilyn Goldammer and Recording Secretary Paul Tuskes. Nominations from the floor will be accepted at the November meeting before voting and installation of officers will be held in December.

Carole Hertz announced that the December Christmas Dinner Party will be held at the Butcher Shop and the cost will be $30/person. See column 2. Prior to the meeting, a book and reprint sale was held and many of us walked away with new treasures for our libraries.

Bob Dees introduced Dr. Kaustov Roy of the University of California at San Diego. Kaustov discussed three factors that impact marine populations; Urbanization of the coastal environment, harvesting, and climate change. In some instances, the impact of climate change may be predicted based on past climatic changes that are reflected in the fossil record. As southern California waters become warmer there is an increased number of Panamic species that migrate north; and as it cools the number of Northern California species that creep below Point Conception increases. The area where change is most likely to be observed is between Santa Barbara, California and Punta Eugenia in Baja California. For example in the early 1970s *Mexacanthina lugubris* appeared in San Diego and now is abundant. At the same time *Nucella emarginata* which had been found in San Diego no longer occurs here.

The plasticity of a species will influence its ability to survive long-term change. Another impact is the increased absorption of carbon dioxide into the ocean and its effect in lowering the pH of the water. As the pH lowers it becomes more difficult to maintain aragonitic shells due to their solubility at lower pH. Historic records show that species that use, or can shift to calcite under this condition have a distinct advantage.
Urbanization results in increased coastal pressure from: use, habitat loss and pollution and can have strong negative impacts if not managed. Harvesting, if managed properly can help sustain population but the take always has an impact. What happens when you focus on catching the largest individuals? It may remove those with the highest fecundity and in some instances influences sex ratios in the population and territorial species may have other consequences in the population structure.

This was an outstanding talk and the information presented was more comprehensive and detailed than can be presented in these minutes.

Following the meeting, discussions with Kaustov continued while others enjoyed the book and reprint sale and the refreshments provided by Bob and Vân Dees and Marilyn and Jim Goldammer.

Paul Tuskes

The Club's Annual Christmas Dinner Party
Saturday December 3rd

It's time to get your reservations in for the Club's annual Christmas Dinner party on Saturday evening, December 3rd. Once again it will be held at *The Butcher Shop* at 5255 Kearny Villa Road in Kearny Mesa (maps can be acquired by going on the restaurant website). The festivities will begin at 6 PM with no-host cocktails, dinner to be served promptly at 7 PM.

The menu for the evening is: mixed greens salad with choices of dressing and rolls and butter. Entree choices are 8 oz. prime rib of beef or fillet of salmon, both served with potatoes and vegetables (a vegetarian plate is available also). Dessert will be white chocolate raspberry cheesecake and coffee or tea. The Club will provide dinner wines as always. The cost of the entire evening is $30 per person.

Our speaker for the evening needs no introduction to our members. Bob Yin, author, noted underwater photographer and Club member, always gives a terrific presentation. His topic will be announced later.

As always, there will be the traditional shell gift exchange. Bring a gift-wrapped shell(s) or shell related item. Put the complete data (locality, collector, date etc.) inside the package only. On the outside attach only very general locality i.e. eastern Pacific, Caribbean, Atlantic. This is a favorite part of the evening and the more people who participate, the more fun the evening will be.

Reservations for this event must be received by Monday, November 28th. Please make your checks payable to The San Diego Shell Club and send to the Club address (first page) and include your entree choice(s) on the check.

If you would like to include your 2012 membership dues on the same check, that will be fine. Just add the $20 for the membership.

It's a great party, don't miss it!!

CUMING'S EASTERN PACIFIC LOCALITIES

EUGENE V. COAN

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Hugh Cuming (1791-1865) (Figure 1) assembled the largest private collection of mollusks of his day, some 19,000 species. It was also particularly remarkable in that he collected a great deal of material himself on expeditions to the Pacific coast of the Americas and to the Indo-Pacific (Anonymous, 1866, 1868; Melvill, 1895; Clench, 1945; Dance, 1980, 1986, 2004.

Cuming moved to South America in 1819, settling in Chile in 1822. In 1827-1828, he left Valparaiso, Chile, to collect in the Indo-Pacific on his own yacht, *The Discoverer*, his first stop being at the Archipiélago de Juan Fernández off Chile. Most importantly for us, in 1828-1829 (or perhaps as late as 1830), he collected extensively in the Americas, from Chiloe Island, Chile, in the south to as far north as El Salvador. After returning to England in 1831, he launched a final expedition to the Philippines in 1836-1840.

In building his collection after his return to England, he purchased much material at auctions. In this way he obtained other specimens from the Panamic Province from stations north of El Salvador, some of which were then used by authors of new species. In some cases, Cuming has been cited as the collector of this more northern material, whereas these lots were actually obtained by others.

The following list, which is arranged from south to north, are the stations where Cuming collected in the Americas, with in several cases a modern translation of the place from those stated by publishing conchologists, together with the latitude of the station. His eastern Pacific stations were cited in papers by various authors. Many of these marine stations were noted by C.B. Adams (1852a: 250-252; 1852b: 26-28), then summarized more completely but cryptically by Carpenter (1857:179-189). Some of them were noted by Olsson (1961: 11-12).

Figure 1. Hugh Cuming (1791-1865). From a lithograph dated 1850. From Dance (1966: 162, fig. 19).

In three cases, I am uncertain where the place was, and perhaps readers may be able to help complete the information. I should also note that in a few cases authors also listed Indo-Pacific localities along with eastern Pacific ones for eastern Pacific taxa, either as a result of labeling errors or because the specimens seemed to be related. These Indo-Pacific stations are not included in the following list.

Locality as given by Broderip, Hinds, Sowerby, or others	Modern Place Name	Latitude	Notes
Insula Chiloe	Isla Chiloe, Los Lagos, Chile	42-44°S	
	Valdivia, Valdivia, Chile	38.8°S	
	Concepción, Bio-Bio, Chile	36.8°S	
	Valparaíso, Chile		
	Archipiélago de Juan Fernández, Valparaíso, Chile	33.0°S	On his first Indo-Pacific expedition
	Coquimbo, Coquimbo, Chile	29.9°S	
	Copiapó, Atacama, Chile	27.4°S	An inland station
Mexillones Bay	Mejillones, Antofagasta, Chile	23.1°S	
Iquiqui	Iquique, Tarapacá, Chile	20.2°S	
	Arica, Tarapacá, Chile	18.5°S	
	Ilo, Moquegua, Perú	17.6°S	
	Cerro Azul, Lima, Perú	13.1°S	
Sinu Callao/Insula St. Laurentii	Callao/Lima, Lima, Perú	12.1°S	
	Huacho, Lima, Perú	11.1°S	
	Casma, Ancash, Perú	9.5°S	
Samanco	Bahía de Samanco, Ancash, Perú	9.2°S	
	Trujillo, La Libertad, Perú	8.1°S	
	Pacasmayo, La Libertad, Perú	7.4°S	
Lambeyque	Lambayeque, Lambayeque, Perú	6.6°S	
Payta	Paita, Piura, Perú	5.1°S	
Tumbez	Puerto Pizarro/Tumbes, Tumbes, Perú	3.5°S	
Isla Muerte, Island of Muerte	Isla Santa Clara, Guayas, Ecuador	3.2°S	
Bay of Guayaquil	Golfo de Guayaquil, Guayas, Ecuador	3.1°S	
	Isla Puna, Guayas, Ecuador	2.8°S	
St. Elena/Sanctam Elenam	Santa Elena, Guayas, Ecuador	2.2°S	
Salango, Columbiae Occidentalis	Isla Salango, Manabí, Ecuador	1.6°S	
Bay of Xipixapi/Jipijapa	Puerto Cayo, Manabí, Ecuador	1.4°S	
Gallapagos Islands/Insular Gallapagos	Islas Galápagos, Ecuador		
(Lord) Hood's Island	Isla Española, Galápagos, Ecuador	1.4°S	
Charles Island	Isla Santa María, Islas Galápagos, Ecuador	1.3°S	
Chatham Island	Isla San Cristóbal, Islas Galápagos, Ecuador	0.8°S	
Albermarle	Isla Isabela, Islas Galápagos, Ecuador		
James Island	Isla San Salvador, Islas Galápagos, Ecuador	0.3°S	
Isla of Plata/Insulam Platae	Isla la Plata, Manabí, Ecuador	0.5°S	
Monte Christe/Montecristi	Manta, Manabí, Ecuador	0.9°S	
Bay of Caraccas/Sinu Caraccensi	Bahía de Caráquez, Manabí, Ecuador	0.6°S	

Atacamas	Atacames, Esmeraldas, Ecuador	0.9°N	
	Esmeraldas, Esmeraldas, Ecuador	1.0°N	
Tumaco	Tumaco, Nariño, Colombia	1.8°N	
Panamam	Golfo de Panamá, Panamá	About 8.9 N	Presumably on the coast at about this latitude
"Ins. Philip.", Panama			Can't find this island
King Is., Isla Rey	Isla del Rey, Archipiélago de las Perlas, Panamá	8.5°N	
Is. Tobago	Isla Taboga, Panamá	8.7°N	
Insulae Sabogae, Sinu Panamae	Alternate spelling for Isla Taboga, Panamá	8.7°N	
Is. Perico, Panama	Isla Perico, Golfo de Panamá, Panamá	8.9°N	
Veragua(s)	Northern Panamá		
Bay of Montejo, "Isle of Lions"	Golfo de Montijo, Panamá	7.6-7.8°N	
Guacomayo		7.8°N	Uncertain; possibly on E. shore of Golfo de Montijo
(Mouth of) Chiriqui	Golfo de Chiriquí, Chiriquí, Panamá	7.8°N	
Isla Caña	Isla del Caño, Puntarenas, Costa Rica	8.7°N	
Gulf of Dulce	Golfo Dulce, Puntarenas, Costa Rica	8.7°N	
Gulf of Nocoiya	Golfo de Nicoya, Puntarenas, Costa Rica	10.0°N	
Puerto Portrero, "Inner Lobos Island"	Puerto Potrero, Guanacaste, Costa Rica	10.5°N	Can't find an Isla Lobos in this area
Real Llejos	Corinto, Chinandega, Nicaragua	12.5°N	
Sinu Fonseca	Golfo de Fonseca, La Unión, El Salvador	13.2°N	
Conchagua, San Salvador	Conchagua, La Unión, El Salvador	13.3°N	Cuming's northernmost
Gulf of Tehuantepec	Golfo de Tehuantepec		Material received from another collector
Acapulcae	Acapulco, Guerrero, México	16.9°N	Material received from another collector
	San Blas, Nayarit, México	21.6°N	Material received from another collector
	Mazatlán, Sinaloa, México	23.2°N	Material received from another collector
Gulf of California/Sinu Californiensi	Golfo de California, México		Material received from another collector
	Guaymas, Sonora, México	27.9°N	Material obtained from Ealing

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44TH ANNUAL MEETING OF THE WESTERN SOCIETY OF MALACOLOGISTS MEETING JOINTLY WITH THE 12TH BIANNUAL MEETING OF THE SOCIEDAD MEXICANA DE MALACOLOGÍA

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Why go from Alaska to La Paz in mid-summer? This year the WSM malacologists met jointly with the Sociedad Mexicana de Malacología in La Paz, Baja California Sur, México, from June 27 - 30, 2011. The meeting was successful in the effort to bring together researchers, students, and others with an interest in all aspects of the study of mollusks.

I left Fairbanks June 25th on a crowded 1:30 AM red-eye flight. In Los Angeles, it was great to meet up with the malacological family, people I'd met at previous WSM meetings. From my window seat on the small prop plane to La Paz, I had a great view of the spine of the Baja California Peninsula and its geology and landscape ecology. Arriving a day early gave me the opportunity for a pre-meeting field trip to Punta Ventana with Hans Bertsch, Doug Eernisse and Mike Vendrasco.

Our central meeting place was the Hotel Perla in the heart of La Paz, on the malecón facing the bay. President Esteban Félix-Pico was a gracious host. He and the organizing committee kept the varied program running smoothly.

The meeting was organized in concurrent sessions held both in the hotel's Madre Perla conference room ans/or the Centro Cultural de La Paz a few blocks away. The Center is a gem of characteristic architecture with stone buildings surrounding a central shaded courtyard. Tall wooden doors closed to keep out the midday sun, and were opened to the evening breezes.

Sessions began with an inaugural ceremony introducing WSM and SMMAC officers and local dignitaries who represented the many sponsors for the

Group photo of the attendees from both societies. Find the ones you know. There were too many to list here. Photo: Courtesy of Hans Bertsch.

event. This joint meeting featured three special events: Paul Valentich-Scott's workshop on the "Bivalves of Baja California", a Symposium on the "History of Malacology in Baja California", and the exhibition "Shells and Snails: that wonderful universe".

The opening symposium on the history of malacology in Baja California provided an introduction to the peninsula's past and present. Highlights included Judith Terry Smith's discussion of the geological setting and its biogeographical implications. Hirume Fujita explained the uses of tools made from fossil shells by the early inhabitants of Isla Espiritu Santo, 8,000 years B.P. Carlos Cáceres Martinez described Pericu people and their use of pearls. Hans Bertsch spoke of the Padre Kino, Abalone and the Island of California, a fascinating story. The abalone theme continued with talks on the history of the abalone fishery and its use in decorative arts. Doug Eernisse recounted the famous Sea of Cortez expedition of Ed Ricketts. Hans Bertsch's talk on the opisthobranchs showed that there is still much to be learned about the molluscan fauna of the Sea of Cortez.

The traveling photographic exhibition from INAH, the Mexican Institute of Archaeology and History, "Conchas y Caracoles: ese universo maravillosa", featured the intricately worked shells used as ornaments by the people of pre-hispanic México. Large format images by photographer Martha Lopes Diaz with the lighting arrangement brought to life the delicacy and sophistication of the pieces.

Sessions, which ran concurrently, included ecology, systematics and phylogeny, paleontology, anthropology, aquaculture and fisheries. Several sessions began with longer keynote talks (40 minutes) each with a format that I felt worked well. With such a varied program, there was much to choose from. Reflecting my interests, my own favorites included the sessions on history and pre-history. I was particularly intrigued by talks describing the shell artifacts from several sites which described the trade routes bringing shells from the Pacific and Caribbean coasts to central México and reconstructed the methods used to turn shell into beads and plates.

Our closing included presentations of the student grant awards and invitations to next year's WSM meeting in Santa Cruz, California, and to the 2013 gathering of the Mexican Society in México City. Afterward we adjourned to a festive final banquet complete with dancing.

The activities ended on July 1 with an excursion to the Sanctuario de los Cactus, a cactus aboretum, and to the beach at Bahia de los Sueños, complete with swimming, beachcombing and another delicious lunch.

I concluded my Mexican experience with a ride up the highway to San Diego with Hans Bertsch and his wife Rosa.

A SELECTED INDEX TO VOLUME XLIII (2011)

BARWICK, KELWIN L. & TONY PHILLIPS
A new record of *Niso attilioi* (Hertz & Hertz, 1982) from Santa Monica Bay, California 61
BLUSTEIN, DANIEL H. & ROLAND C. ANDERSON
Octopuses drill crab chelae on the inside (oral side) 6
CHANEY, HENRY (reviewer)
Book review: *Encyclopedia of Texas Seashells, Identification, Ecology, Distribution & History* 35
COAN, EUGENE V.
Cuming's eastern Pacific localities 109
FÉLIX-PICO, ESTEBAN FERNANDO, MARTÍN E. HERNÁNDEZ-RIVAS, OSCAR EFRAÍN HOLGUÍN-QUIÑONES, & GERARDO VARGAS-LÓPEZ
The zonation and density of the micromolluscs living in the mangrove swamps of the sand barrier of El Mogote, La Paz, Baja California Sur, México 29
FOSTER, NORA
44th annual conference of the Western Society of Malacologists meeting jointly with the 12th biannual meeting of the Sociedad Mexicana de Malacología 115
GARCÍA, EMILIO F.
Sea star stomach uncovers geographical extension for *Parvanachis guerreroensis* Strong & Hertlein, 1937, and other goodies 93
GROVES, LINDSEY T.
The 15th annual SCUM gathering 54
HERMOSILLO-GONZÁLEZ, ALICIA
Species list of opisthobranch mollusks for Bahía de Banderas (Jalisco-Nayarit), Pacific coast of México 39
Errata: *Species list of opisthobranch mollusks for Bahía de Banderas (Jalisco-Nayarit), Pacific coast of México* by Alicia Hermosillo-González 58
HERTZ, CAROLE M..
In Memoriam: William T. Schneider 36
HERTZ CAROLE M. & BARBARA W. MYERS
Notes on a Californian pectinid species 79
Book News: *A Conchological Iconography. The Family Pectinidae* by Raines & Poppe, 2006 (reviewed) 105
HEWITT, SUSAN J.
A 40-minute survey on the marine mollusks of the island of Saint Kitts, Leeward Islands, West Indies 3
An expanded survey of the marine mollusks of the island of Saint Kitts, Leeward Islands, West Indies 83
An 18th century account of marine mollusks from the island of Nevis, Leeward Islands, West Indies 95
An ancient archeological marine mollusk assemblage from the island of Nevis, Leeward Islands, West Indies 101
LILLY, MEGAN (reviewer)
Book Review: *Octopus The Ocean's Intelligent Invertebrate* by Mather, Anderson & Wood 56
MOGOLLÓN, VALENTÍN & GRACE VICTORIA MONTALVÁN
First records of twenty species of Turridae (Mollusca) in Perú, with notes on three other species 11
SASSI, ALEXANDER P.
A survey of intertidal mollusks with the Pacific Northwest Shell Club at Shannon Point Marine Center, Anacortes, Washington 63
TUSKES, PAUL (compiler)
Minus tides in San Diego for remainder of 2011 26
TUSKES, PAUL M.
Black Abalone (*Haliotis cracherodii*) on Mission Bay Jetty 57
Observations on the biology of the Bubble Snail *Bulla gouldiana* in Mission Bay, San Diego, California 69

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THE FESTIVUS

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Meeting date: third Thursday, 7:30 PM,
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PROGRAM

Cypraea of the Continental United States and the Hawaiian Islands

Two very knowledgeable cowrie enthusiasts, David Waller and William Schramm, will present an illustrated program on this favorite mollusk family. Be sure to attend.

Meeting date: January 19, 2012

CONTENTS

Club news 2
Pharmaceuticals at sea: effects of the pharmaceutical Ibuprofen on embryonic development of *Stronglocentrotus purpuratus*
EMMA JACKSON & CHRISTINA TORRES 3
A five-minute survey of marine mollusks from the island of Antigua, Leeward Islands, West Indies
SUSAN J. HEWITT 7
Low tides for 2012 at San Felipe, Baja California, México
JULES HERTZ (Compiler) 9

CLUB NEWS

San Diego Shell Club Minutes
17 November 2011

The meeting was called to order at 7:45 P.M. by Jules Hertz, President. The previous minutes were accepted as published. There was no report from the treasurer as she was absent. The nominations for 2012 officers were announced again, and after asking if there were any nominations from the floor (none were offered) the slate was approved by the membership present.

Carole discussed the holiday meeting in December at the Butcher Shop restaurant. Please send your check for the dinner meeting ASAP ($30/person). Activities start at 6 PM, dinner at 7 and the program at 8 PM. Remember to bring some shells for the exchange.

The speaker at the November meeting was Dr. Greg Rouse, who had just returned the previous week after 50 days of sampling benthic organisms from the margins of the Scotia Sea. The purpose of the trip was to sample a wide range of organisms at key sites in order to understand the extent of variability and evolutionary relationships. The Scotia Sea is bounded by an oblong under-sea ridge with numerous islands, the most notable of which are South Georgia, South Orkney and the South Shetland Islands. The ridge extends from the southern-most tip of Argentina eastward perhaps 1500 miles to the South Sandwich Islands where it swings south, and then westward back to the northern tip of the Antarctic Peninsula. The area that lies directly between Argentina and the northern tip of the Antarctic is Drake's Passage where the winds and the current move from west to east. Although many species appear to occur along the entire 3000+ mile ridge, the mechanism of gene flow is difficult to image considering the currents and topography. By collecting the same organisms at each location he expects to learn a great deal about the level of isolation between populations. DNA sequencing of the samples and data analysis will require 1-2 years. Greg shared excellent photos of life on board the ship, the sampling methods, preservation of material for analysis and interesting adventures while on the trip. We hope to have him speak again once the data are analyzed.

The door prize was won by Carole Hertz and the refreshments were provided by Stephen Mulliner and Marty Schuler.

Paul Tuskes

The Club's Annual Christmas Dinner Party
Saturday December 3rd

The Club's Christmas Dinner party was a huge success. The thirty-two people in attendance made it our largest party yet and it was great fun and delicious. By popular demand, reservations have already been made there for next year on the first Saturday in December.

MC Carole Hertz officially opened the party at 7 PM with welcoming words and stories. She announced a big and greatly appreciated surprise. It was that Marty Schuler, who was unable to attend because of work constraints, had donated a beautiful drawing, this one of *Typhis latipinnatus*, to be raffled off at the end of the evening. The lucky winner of the exquisite drawing was Larry Catarius.

After the delicious entrees, President Jules Hertz thanked his 2011 board and committee chairs for their considerable help and then announced and installed the new board. New president Bob Dees became the holder of the original members' plaque and the rosewood gavel. The list of the new officers and board can be found on the first page of the issue.

Following dessert – a ?low calorie raspberry cheesecake - Bob Yin gave the evening's presentation on his travels in Malaysia with images of the underwater animals with some beautiful shots of shells of the area. He also showed the ease with which people were taught to dive there. After the lengthy question period, about half the people were ready to leave for Malaysia!!

Bob's enjoyable talk was followed by the traditional gift exchange which closed the evening's program. But people remained, enjoying each other's company and reluctant to end the evening.

It was a great party.

Dues are Due

It is time to renew your subscription/membership in the San Diego Shell Club. Dues have not been raised. For those who have not renewed, this will be your last issue.

The Club's annual membership roster will be published in the February issue. Make sure that you are on it!!

PHARMACEUTICALS AT SEA: EFFECTS OF THE PHARMACEUTICAL IBUPROFEN ON EMBRYONIC DEVELOPMENT OF *STRONGYLOCENTROTUS PURPURATUS**

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Abstract A bioassay was conducted to determine the possible effects of Ibuprofen on fertilization success and embryonic development of the Purple Sea Urchin. The results show that fertilization success was not affected by exposure to the tested concentrations of Ibuprofen, but that embryonic abnormalities were greater than in the controls.

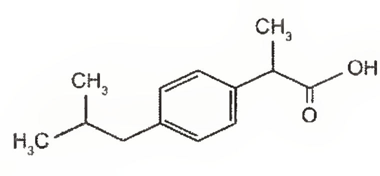
Introduction

Ibuprofen (4-isobutylphenyl) is the third most consumed drug in our world (Murdoch, 2005). This non-steroidal anti-inflammatory drug is used to treat mild headaches and other body pains that are not severe. Ibuprofen and many other drugs that appear in human waste such as antibiotics, anti-depressants, birth control pills (estrogen), cancer medications, seizure medications, tranquilizers, pain killers, and cholesterol compounds are being found in our fresh and salt water sources (Donn, et al., 2008).

In testing environmental toxins, *Strongylocentrotus purpuratus* has been shown to be a good bio-indicator and its embryonic development is easy to observe and has been well documented. It is also relatively simple to gather the eggs and use them to produce embryos (Schroeder, 1986). Environmental endocrine disrupting compounds have been shown to impact *S. purpuratus* and *Lytechinus anamiesus* development (Roepke et al., 2004). No other studies have been published testing the potential impact of Ibuprofen on sea urchin embryos.

Data shows that about 60-90% of Ibuprofen is already being removed from water systems (Science Daily, 2010). Ibuprofen has a half-life of around two hours in the body (Ibuprofen, 2008). Traces of Ibuprofen and Acetaminophen travel through the human digestive system and are eventually released from the body in the form of waste. This waste makes its way into our sewer systems and our water treatment plants. Municipal water departments treat water, but not for these drugs. The treatment is primarily for bacteria, viruses and other harmful substances with the use of chlorine and other chemicals (Jjemba, 2008). Recent studies show that chlorine might actually be making the pharmaceuticals in waste water more toxic (Donn et al., 2008). In San Diego, Ibuprofen, meprobamate, and phenytoin have been found in local drinking water. This study evaluates the effect of Ibuprofen on developing embryos of *Strongylocentrotus purpuratus*.

The active ingredient in Ibuprofen is 2-(4-isobutylphenyl) propionic acid, but the tablet also contains carnauba wax, talc, colloidal silicone dioxide, corn starch, crosscarmellose sodium, magnesium stearate, PD & C yellow #6, iron oxides, microcrystalline cellulose, propylene glycol, polyethylene glycol, polyvinyl alcohol, stearic acid, and titanium dioxide. The chemical structure of the active ingredient is shown below in Text figure 1.



Text figure 1. Chemical structure of the active ingredient in Ibuprophen: 2-(4-isobutylphenyl) propionic acid.

*This paper summarizes the winning project selected by the San Diego Shell Club at the 2011 Greater San Diego Science & Engineering Fair. The two authors were then Junior year students at High Tech High in San Diego.

Methods

A bioassay was conducted in order to determine possible effects Ibuprofen would have on the fertilization and embryonic development of *S. purpuratus*. A stock solution was created containing 200mg (one single crushed pill) of Ibuprofen in 1 liter of seawater. The seawater was collected from the Scripps Institution of Oceanography, approximately 16 miles from the Point Loma Wastewater Treatment Plant. Two separate solutions were then created using this stock solution.

Three μg/l of Ibuprofen were found in influents at select water waste treatment plants and metabolites of Ibuprofen, hydroxy-IB and carboxy-IB, were at higher concentrations (Buser, 1999). Via dilution, two test concentrations were generated from the stock solution. The solution containing 3μg/l Ibuprofen was labeled as the diluted solution. Solution two was 25 times stronger (75 μg/l) and was labeled the concentrated solution. A seawater control was also used for this experiment. In the end, three solutions were used: the concentrated solution, the diluted solution, and a seawater control.

The *S. purpuratus* were spawned by injecting 1 to 2ml doses of 0.5 M potassium chloride (KCl) into their body cavity. The only way to determine the gender was to wait for gametes to be shed. Gametes were collected using a pipette and were placed into three separate 1.5 ml micro centrifuge tubes (control and both test solutions).

The tests conducted on the gametes were either pre-treated or untreated. Pre-treated means that the sperm and egg were collected and individually exposed to an Ibuprofen (or seawater) solution before they were combined. Untreated means the gametes were not individually exposed to Ibuprofen before they were mixed together. There were pre-treated and untreated gametes for all three solutions. Gametes were placed in test solutions for approximately an hour and maintained at 20-21°C. A 50 μl drop from each treatment was examined under a compound light microscope. The fertilized and unfertilized eggs were then observed. Fertilized eggs had fertilization membranes around them. These membranes look similar to halos. The number of unfertilized and fertilized eggs were counted and recorded. The sample size was 1000 eggs per slide in all tests. Three slides were counted per solution. The fertilization success rates are shown in Graphs A and B This was then taken and converted to percentages which are shown in Graphs C and D.

Embryonic Development

The process of embryonic development is as follows. After the egg is fertilized it splits and becomes a 2 cell. Following this, the embryo splits again into a 4 cell, and then again into an 8 cell (Schroeder, 1986). The embryo continues to divide until it takes the form of a morula. The morula (or raspberry) has the appearance of a bundle of uncountable embryonic cells clustered together.

After this stage is the swimming blastula state, in which the morula begins to spin in circles and move around. This is the last stage of embryonic development before the embryo begins to grow into an organism. A healthy embryo has the shape of a perfect circle, and is clear of any misshapen aspects. Abnormal embryos are easily sorted from healthy ones, as they are not perfectly circular in shape, or have odd deformities of cells (Figures 1-6).

Results and Discussion

Graph A shows the fertilization success of the untreated gametes. Untreated means the gametes were put together and then exposed to the Ibuprofen or control solution. Graph B shows the fertilization success of the untreated gametes vs the controls. Pre-treated means the sperm and eggs were individually treated with the solution before the gametes were combined. These graphs show the average percentage of fertilized and unfertilized eggs for the solutions.

It had been predicted that the Ibuprofen solutions would have a significantly low percentage of fertilized eggs. However, this is not the case. As seen below, the percentage of fertilized eggs that were pre-treated exceed the control. Therefore, it has been concluded that Ibuprofen does not affect the fertilization success of the eggs and has no immediate adverse effects.

After 24 more hours, the gametes were examined under a microscope again. This time, each developmental stage of the embryos was counted. Graphs C and D show the embryonic development of the embryos. These samples were taken after the embryos had soaked in the Ibuprofen and control solutions for 25 hours. Graph C shows the average percentage of each developmental stage of the embryos found in the pre-treated solutions. Graph D shows the average percentage of each developmental stage of the embryos found in the untreated solutions. In Graph C, the percent of unknown/abnormal embryos in both the diluted and

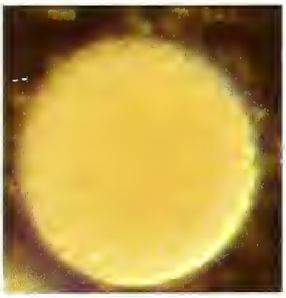


Figure 1. An unfertilized egg a 100x.

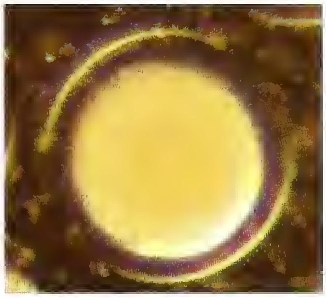


Figure 2. A newly fertilized egg with halo at 100x.

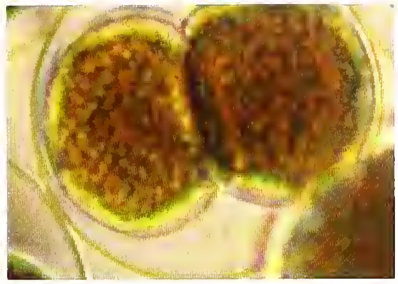


Figure 3. An embryo at the 2-cell stage at 100x.

Figure 4. An embryo at the 4-cell stage at 100x.

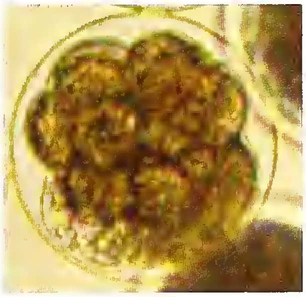


Figure 5. An embryo at the Morula stage at 100x.

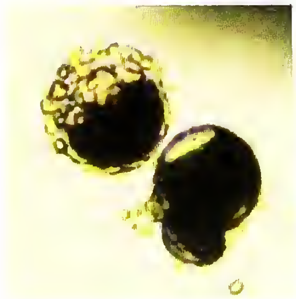
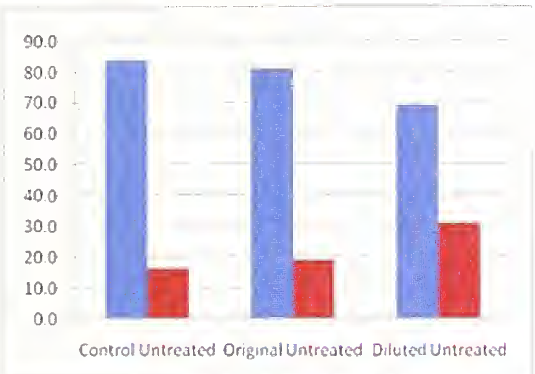
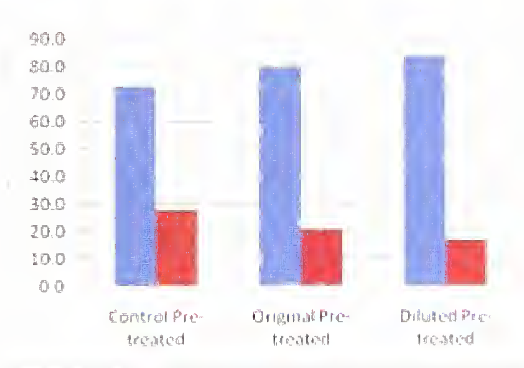


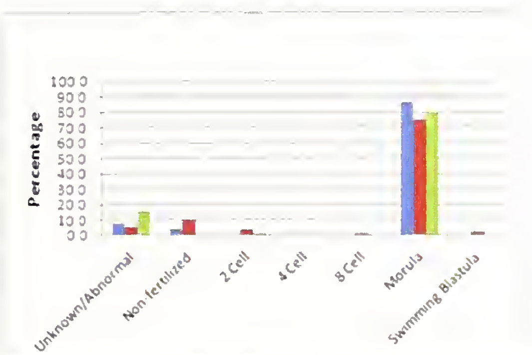
Figure 6. Two abnormal embryos at 100.x



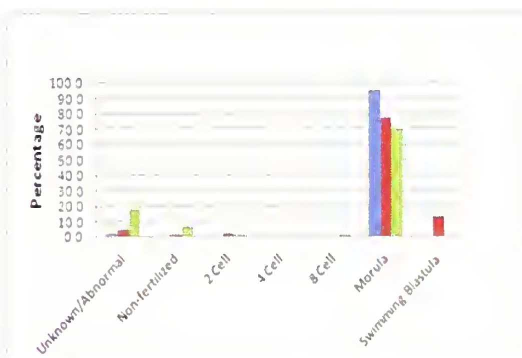
Graph A: Percentage of fertilization success of Untreated gametes. All three treatments had a high degree of fertilization success that was verified with this test.



Graph B: Percentage of fertilization success of Pre-treated gametes versus the controls. The pre-treatment of gametes showed less variation than gametes that were untreated.



Graph C: The average percentage of each developmental stage of the embryos found in the Pre-treated solutions. Blue represents the diluted pre-treated eggs, red represents the control pre-treated, and green represents the concentrated pre-treated eggs.



Graph D: The average percentage of each developmental stage of the embryos found in the Untreated Gametes Solutions. Blue represents the diluted pre-treated eggs, red represents the control pre-treated, and green represents the concentrated pre-treated eggs.

concentrated Ibuprofen pre-treated solutions are higher than the control. Based on these results, data suggest that Ibuprofen may have an adverse effect on the embryonic development. Although these results document embryo abnormalities, the pills that were crushed to create the stock solution contained other nonactive ingredients that may or may not be responsible for these results. Nonetheless, the Ibuprofen pills used for this experiment caused abnormalities in embryonic development.

If this experiment were to be repeated, it would be a priority to (1) test pure Ibuprofen rather than the compounds found in tablet form and (2) extend study to address later stages of development. The embryos died after two or three days due to the lack of nutrients. If the embryos had lived longer we would have had the ability to determine whether Ibuprofen has long term effects on further embryonic developed. Our high school laboratory had limited equipment, which made it difficult to control temperature and salinity. These are two major factors for embryonic experimentation.

Acknowledgments

We would first thank the San Diego shell Club for this opportunity. Thanks are also due to our biology teacher Dr. Jay Vavra, for mentoring us on this project for a good part of the year. This experiment would not have been possible without his help. Thanks are also due to our teachers Tom Fehrenbacher and Julia Gordon for understanding when we had to leave their classes to work on this project. Our appreciation also to Dr. Paul Tuskes for his considerable help in making this essay ready for publication.

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A FIVE-MINUTE SURVEY OF MARINE MOLLUSKS FROM THE ISLAND OF ANTIGUA, LEEWARD ISLANDS, WEST INDIES

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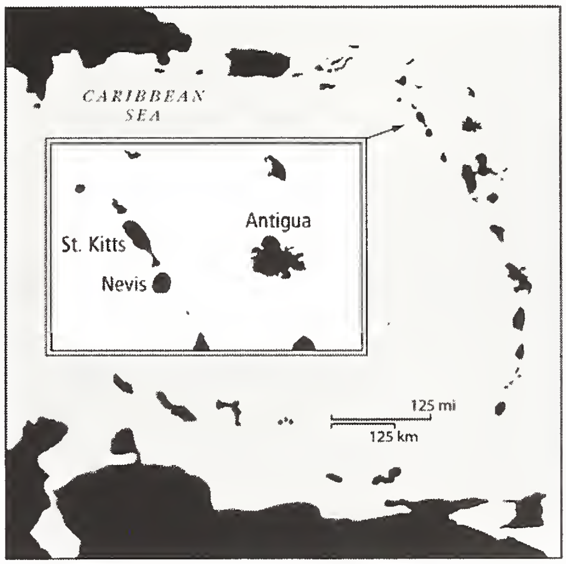
Introduction

The island of Antigua is situated at 17°5' N, 61°48' W; it is part of the outer arc of the northern half of the Leeward Island chain of the Lesser Antilles, West Indies (Map 1). Antigua is 100 km due east of the island of Nevis, which since 1997 has been my main focus of study during annual visits.

A friend of ours who lives on Nevis, Quentin "Beeman" Henderson, has previously brought back shells for me when he travels to other islands (for example see Hewitt, 2010). On March 31, 2011, Quentin was at a beach on the northwest coast of Antigua, on Fort Bay in Saint John Parish, and while there he spent 5 minutes hand picking and scooping a small sample (two handfuls) of beach-drift shells into a plastic bag. Quentin gave me the bag when I arrived on Nevis on April 17, 2011. I was eager to see whether the shell sample contained any species that were not listed on Gary Rosenberg's database of Western Atlantic marine mollusks, Malacolog 4.1.1, which has a total species list for Antigua of 132.



Map 1: The Lesser Antilles from Hispaniola to Venezuela, with an inset showing part of the inner and outer arcs of the northern section of the Leeward Island chain, including Antigua.

Species Collected

In the following list, species that were already recorded for Antigua on Malacolog 4.1.1 are displayed in smaller font size; the species that represent new records are displayed in normal size.

Gastropoda

Fissurellidae

Hemitoma octoradiata (Gmelin, 1791)
Diodora dysoni (Reeve, 1850)
Diodora cayenensis (Lamarck, 1822)

Naticidae

Naticarius canrena (Linnaeus, 1758)

Cerithiidae

Cerithium atratum (Born, 1778)

Modulidae

Modulus modulus (Linnaeus, 1758)

Calyptraeidae

Bostrycapulus aculeatus (Gmelin, 1791)

Ranellidae

Cymatium martinianum (d'Orbigny, 1846)

Buccinidae

Engina turbinella (Kiener, 1835)

Columbellidae

Columbella mercatoria (Linnaeus, 1758)
Suturoglypta pretrii (Duclos, 1846)

Muricidae

Coralliophila caribbaea Abbott, 1958

Olivellidae

Olivella minuta (Link, 1807)

Bullidae
Bulla striata Bruguière, 1792

Bivalvia

Pteriidae
Pteria colymbus (Röding, 1798)
Arcidae
Arca zebra (Swainson, 1833)
Anadara notabilis (Röding, 1798)
Pectinidae
Argopecten nucleus (Born, 1778)
Cardiidae
Acrosterigma magnum (Linnaeus, 1758)
Trachycardium isocardia (Linnaeus, 1758)
Trachycardium muricatum (Linnaeus, 1758)
Veneridae
Chione cancellata (Linnaeus, 1767)
Chamidae
Chama radians Lamarck, 1819
Chama congregata Conrad, 1833
Donacidae
Donax denticulatus Linnaeus, 1758

The fact that some fine gravel had been accidentally scooped up along with the shells was advantageous: it meant that several small species were present that would not have been included if every shell had been hand picked. Some broken shells and shell fragments in the sample were recognizable to the species level.

A total of 25 species were in the sample: 14 gastropods and 11 bivalves. The Malacolog 4.1.1 Antigua list of 132 species includes only 11 species of bivalves, and so, not surprisingly, 10 out of 11 of the bivalve species in the sample were new records for Antigua. Of the 13 gastropods in the sample, 4 were new records.

The bivalves included the largest shells in the sample and the most numerous valves of individual species: there were 5 valves of *Arca zebra*, 8 valves of *Trachycardium muricatum*, and 11 valves of *Donax denticulatus*, including one whole shell.

As a group, the current list represents a sandy bay habitat with adjacent rocky areas. Sand-dwelling species predominate, but there are also many species that live on or under rocks, and one coral-dwelling species.

Results

Twenty-five species from Fort Bay, Antigua, is a first look at the fauna of that bay. In terms of the faunal list for the island of Antigua, the 15 species not represented in the Malacolog 4.1.1 list are a useful addition, bringing the total for Antigua up to 147. The current study demonstrates how easy it is for even an untrained volunteer to find material that adds species to an underdeveloped faunal list, assuming someone more expert is available to identify the shells. If there is an opportunity to visit Antigua in 2012, I will attempt to expand the species list further.

Acknowledgments

I am very grateful to Quentin Henderson for collecting the sample and bringing it to Nevis for me. Many thanks to Harry G. Lee for identifying the *Olivella* species and confirming the identity of the *Suturoglypta*. Thanks to Colin Redfern for confirming the identity of the *Diodora cayenensis*. The information from Gary Rosenberg's database Malacolog 4.1.1 is provided with the permission of the ANSP.

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LOW TIDES FOR 2012 AT SAN FELIPE, BAJA CALIFORNIA, MÉXICO

The entries below show periods of low tides of -3.90 feet and below. The times of low tides are given in Pacific Standard Time, except those dates marked with an asterisk which are in Pacific Daylight Time. To correct for Puerto Peñasco add one hour to listed times when they are in Pacific Standard Time. Tides below the midriff of the Gulf cannot be estimated using these entries. All entries are approximate times and tides.

Jan. 23	8:39 p.m.	-3.95 ft	May 6	9:11 a.m.*	-5.50 ft	Sep. 17	9:59 p.m.*	-4.13 ft
Feb. 7	8:13 p.m.	-4.46 ft	May 7	9:53 a.m.*	-5.00 ft	Oct. 14	8:26 p.m.*	-4.70 ft
Feb. 8	8:47 p.m.	-4.53 ft	Jun. 2	7:30 a.m.*	-3.93 ft	Oct. 15	9:02 p.m.*	-5.27 ft
Mar. 7	7:56 p.m.	-4.57 ft	Jun. 3	8:15 a.m.*	-4.87 ft	Oct. 16	9:39 p.m.*	-5.10 ft
Mar. 8	8:18 a.m.	-3.95 ft	Jun. 4	8:59 a.m.*	-5.19 ft	Oct. 17	10.19p.m.*	-4.18 ft
Mar. 8	8:32 p.m.	-4.58 ft	Jun. 5	9:43 a.m.*	-4.83 ft	Nov. 12	7:05 p.m.	-5.08 ft
Mar. 9	8:52 a.m.	-4.40 ft	Jul. 2	8.08 a.m.*	-4.26 ft	Nov. 13	7:45 p.m.	-5.66 ft
Mar. 10	9:27 a.m.	-4.16 ft	Jul. 3	8:52 a.m.*	-4.75 ft	Nov. 14	8:26 p.m.	-5.50 ft
Apr. 6	8:52 a.m. *	-4.97 ft	Jul. 4	9:34 a.m.*	-4.61 ft	Nov.15	9:09 p.m.	-4.59 ft
Apr. 7	9:29 a.m. *	-5.33 ft	Aug. 1	8:44 a.m.*	-4.28 ft	Dec.11	6:52 p.m.	-4.77 ft
Apr. 8	10:07a.m.*	-4.90 ft	Aug. 2	9:21 a.m.*	-4.24 ft	Dec.12	7:36 p.m.	-5.53 ft
May 4	7:50 a.m.*	-4.25 ft	Sep. 16	9:08 a.m.*	-3.93 ft	Dec. 13	8:20 p.m.	-5.58 ft
May 5	8:30 a.m.*	-5.23 ft	Sep. 16	9:25 p.m.*	-4.15 ft	Dec. 14	9:04 p.m.	-4.90 ft

Compiled by Jules Hertz

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THE FESTIVUS

A publication of the San Diego Shell Club

Volume: XLIV | February 9, 2012 | Number: 2

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Meeting date: third Thursday, 7:30 PM,
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PROGRAM

SUMMARY OF THE MISSION BAY SURVEY

Paul Tuskes will discuss the Mission Bay Survey that turned up 187 species of mollusks. Changes to the marine habitats and how that has influenced molluscan diversity over the past 80 years will be discussed and new underwater photos and new and exciting additions to our fauna will be reviewed. Did you know we have three species of miters and three species of olives?

Meeting date: February 16, 2012

CONTENTS

Club news 12
Survey of Mission Bay mollusks, San Diego, California
PAUL M. TUSKES 13
References with molluscan information on Mission Bay, San Diego, California (other than those in Tuskes, 2012)
CAROLE M. HERTZ & JULES HERTZ, compilers 30
Club roster for 2012 for detaching

CLUB NEWS

San Diego Shell Club Minutes
19 January 2012

The meeting was called to order at 7:42 P.M. by past president Jules Hertz in the absence of Bob Dees. The previous minutes were accepted as published in *The Festivus*. Silvana Vollero gave the treasurer's report and all is well. Carole Hertz announced that the Club auction will be held on April 28th, so mark that date on your calendars.

Members David Waller and Bill Schramm were the speakers for the evening. They gave a presentation on the *Cypraea* of the United States with beautiful photos of both shells and animals and gave information on size, rarity, color forms etc. Four species, including the largest (*Cypraea cervus* to 190 mm) occur in the southeast United States. There is only one *Cypraea* species in southern California, *Cypraea spadicea*. The Hawaiian Islands have 35-38 species. Bill and David showed photos of both collected material and live animals and discussed distinguishing characteristics for those species that are often confused. They also brought in examples of the various species for members to examine. It was a program enjoyed by all. Wes Farmer won the door prize.

After the meeting, members continued to enjoy the cowrie display and asked many questions of the speakers while enjoying the snacks provided by Marilyn and Jim Goldammer and Paul and Ann Tuskes.

Paul Tuskes

A New Member of The Festivus Review Board

It is our pleasure to welcome Lance Gilbertson to the review board of *The Festivus*. Lance studied southwestern land snails at the University of Arizona for his MS degree and returned there on two sabbaticals for further studies sponsored by the late Dr. Walter Miller.

He has been a professor of zoology and ecology at Orange Coast College in Costa Mesa for forty years and has described species of *Holospira* and *Sonorella* from the southwestern states and northern Mexico. He is currently a Museum Associate at the Natural History Museum of Los Angeles County.

Save the date for the Auction/Potluck
Saturday, April 28th

The auction preparations have already started. The auction/potluck will be held once again at Wes Farmer's Club House and the festivities will begin at 5 PM for Dave's Punch (and other beverages) while members and guests browse the voice auction table and the silent auction items. At 6 PM, the potluck will begin with special entrees, salads and desserts provided by those attending. And promptly at 7 PM the voice auction will begin with all the excitement that bidding on the lovely shells always brings. Included in all the fun is the One-dollar table which will magically appear half way though the auction.

Beginning at the February meeting the sign-up sheet for the auction will be passed around and members hoping to attend the auction can sign on for salad, entree, or dessert to serve 12. We hope that you all plan to attend the fun event.

The Club will greatly appreciate donations from members and friends of books, quality shells or art work to support the Club and its activities such as *The Festivus*.

A Special Meeting in March

The March meeting will be an exciting and special one. Paul Valentich-Scott and Eugene Coan have authored a new two volume work on the bivalves of the Panamic Province with all illustrations in color. The two authors, who are longtime members of the Club, will give a program discussing different aspects of the books and will be available for questions.

They will be bringing books for members to view and will take orders for any that attendees wish to buy. The authors are willing to autograph books for those who might wish it.

Instead of our normal "Coffee Time," The Club will be providing hors d'oeuvre and beverages in addition to coffee and desserts. It will be party time and an exciting program for all. Please plan to attend and welcome Paul and Gene.

Dues are Overdue

SURVEY OF MISSION BAY MOLLUSKS, SAN DIEGO, CALIFORNIA

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Abstract: This paper identifies 187 species of mollusks found in Mission Bay, San Diego, California, and lists their relative abundance and habitat. Changes to the bay during the past century have modified the configuration, access, and habitats and the relevance of those changes are discussed in relation to four surveys that span 80 years. The current survey reports greater species diversity than in the past, these results are due to increased habitat complexity and improved sampling techniques.

Introduction

Mission Bay is a few miles north of San Diego Bay in Southern California. Mission Bay Park, which encompasses the bay and shoreline, is funded and managed by the City of San Diego. The current survey of mollusks in Mission Bay was conducted by members of the San Diego Shell Club during 2008-2010. Prior to the current work, the most recent survey was published 53 years ago.

Mission Bay History

The original name for Mission Bay was False Bay and some old data labels in the San Diego Natural History Museum still reflect that name. The bay was a shallow estuary formed by the westward flow of the San Diego River which discharged intermittently between both Mission Bay and San Diego Bay. To prevent silting of San Diego Bay, the Army Corps of Engineers constructed a berm that directed the river to Mission Bay which was too shallow for commercial shipping activity.

Prior to the development of Mission Bay, the City of San Diego designated the bay for recreational use and that designation has guided the development of the bay and surrounding areas. Activities around the bay include housing, hotels, parks, sport fishing boats, marinas, and two amusement parks. There has been no commercial or military shipping in the bay and no notable industrial activity near or along its shores, which has kept the bay relatively free of industrial pollution.

Before dredging and development in the 1940s the backwaters of the estuary were mud and organic sediment deposited by Rose Creek, the San Diego River, and Tecolote Creek which flows seasonally from the hills on the east side of the bay. The sand peninsula now known as Mission Beach forms the western margin of the bay (Figure 1). The only hard substrate would have been river rock that lies on the bottom of past channels and is still present in some areas. Orcutt (1885) described False Bay (Mission Bay) as a "large lagoon... which possesses extensive muddy flats and a narrow peninsula of sand and dunes on the west".

In 1914 a group of San Diego businessmen purchased the sand peninsula between Ocean Beach and Pacific Beach. The property would later be subdivided and called Mission Beach. In 1915 a bridge was constructed that spanned the channel and for the first time provided a direct route from Ocean Beach, via the peninsula, to Pacific Beach approximately three miles to the north. The purpose of the bridge was to increase access and land values in Mission and Pacific Beaches, but ultimately the recreational value of the bay was recognized.

The next major change to the bay came in 1946 when dredging began to transform the estuary into a large aquatic park. The initial dredging removed 25 million cubic yards of material. By 1948 many of the points and coves that would become prominent landmarks had been created and the Ventura Bridge was under construction, as were the north and south jetties that would define the new navigable channel. Prior to 1950 the San Diego River was channelized to prevent sedimentation of the newly dredged bay, and discharged at its current location between the south jetty and Ocean Beach. The old bridge linking Ocean Beach to Mission Beach was demolished making the channel navigable. More dredging and additional islands and shoreline would be created in future years, but this initial event modified the habitats within the bay and set the stage for a 4,600 acre aquatic park visited by 5,000,000 people a year. Currently the bay has approximately 27 miles of

shoreline. The development of the bay significantly modified its shoreline and marine habitats. Figure 2 shows the present configuration of the bay.

Mission Bay - Marine Habitats

Mission Bay supports a wide variety of habitats from a small estuary at the mouth of Rose Canyon Creek in the northeast portion of the bay to fast flowing oceanic conditions that occur in the channel. Each habitat is influenced by the amount of wave and tidal energy that typically moves through the habitats twice daily.

Mission Bay Channel has a clean sand bottom with patches of river rock and eelgrass. The depth ranges from 20 to 30 feet and there are strong tidal flows. A persistent ocean swell moves down the channel and at time waves break along nearly the entire length of the inner jetty. The jetty and sides of the channel are lined with large rip-rap (large angular rocks). The rock habitat supports oceanic algae that form a linear kelp bed on the south jetty and where river rock is exposed near the margins of the channel. To the east of Ventura Bridge, the channel is bisected by Vacation Isle. One arm of the channel swings south of Vacation Isle, in an easterly direction to the back-bay (Figure 2). The other arm continues north along the west side of Vacation Isle and then turns east to the back-bay. Indicator species are large colonies of sand dollars and various species of sea pens. Rip-rap west of Ventura Bridge supports kelp such as *Macrocystis pyrifera* and *Egregia menziesii*, many species of sponge, gorgonians and solitary corals. Indicator fish include wrasses, pelagic damsels, garibaldi, moray eels, sand bass and the black-eyed goby. In 2010 the channel was dredged from the entrance to the Ventura Bridge.

Outer Coves that connect to the main channel are typically sandy with eelgrass; the deepest and most protected areas have sand/sediment bottoms. The underwater surge that moves down the channel is felt within these coves. The water movement is sufficient that portions of the beaches are lined with rip-rap. Examples include South Cove, Ventura Cove, Mariner's Basin, and Quivira Basin. Quivira Basin has slips for recreational craft and is more protected than the other outer coves with some characteristics of bay coves. Indicator fish are spotted bass and horn shark.

Bay Coves and Beaches have sandy shores while the subtidal bottom is sand, sediment, and eelgrass. There is flow from changing tides, but the underwater surge associated with the swells that enter the channel is not present in these inner coves and beaches. Examples include Santa Barbara, San Juan, and Santa Clara coves, Sail Bay, Riviera, Crown, Ski, and Fiesta Island beaches.

Salt Marsh habitat is very restricted in Mission Bay and found only within the small Northern Wildlife Refuge adjacent to the Rose Creek Inlet. The shore and bottom are primarily sediment. Individuals are not allowed to enter the refuge without prior permission and a series of buoys restrict boat access. Indicator plants are pickleweed (*Salicornia* sp.) and *Spartina* sp. MacDonald (1969) surveyed this habitat extensively and reported only nine species of mollusks. Personal observations during the current study identified few additional species, but no unique species were found. Mollusk diversity was very low although individual species could be abundant. As a result of current and past observations no study site was established in this habitat.

Methods

Figure 2 identifies targeted survey sites, and other locations that were visited during this study. The marks on the map representing targeted sites is intended only to draw your attention to the location. Therefore a large blue dot at Santa Clara Point indicates the entirety of that area.

Dates and locations for sampling were suggested based on habitat and tides. As many as eight people visited a site at one time. The targeted locations and approximate number of visits during minus tides are as follows: Outer coves: South Cove (7), Ventura Cove (10), Mariner's Point and Basin (10); Inner Bay; Santa Clara Point (5), Ski Beach (7), Stony Point (Fiesta Island) (10); Mission Bay channel from the jetties to Ventura Bridge (10). Reports were submitted by: John Bishop, Clint Crowe, Bob Dees, Wes Farmer, Carole & Jules Hertz, John LaGrange, Chris & Julie Humes, Charlie & Taylor Lepore, Nancy, Bill & Lexi Schneider, Ann & Paul Tuskes, and David Waller. Other locations visited on low tides included: Crown Point, De Anza Cove, Quivira Basin, beaches on the east side of the bay and the Wild Life Refuge.

SCUBA and snorkeling data were collected by Larry Catarius, John LaGrange, and Paul Tuskes at the following locations: Ventura Cove area (10), Mariner's Basin (10), Quivira Basin (10), Mission Bay Jetty and channel (30+), South Cove (2), North Cove (1), Bonita Cove (1), and De Anza Cove (1). A survey form was distributed in an effort to standardize data collection and specific locations were recommended in order to sample

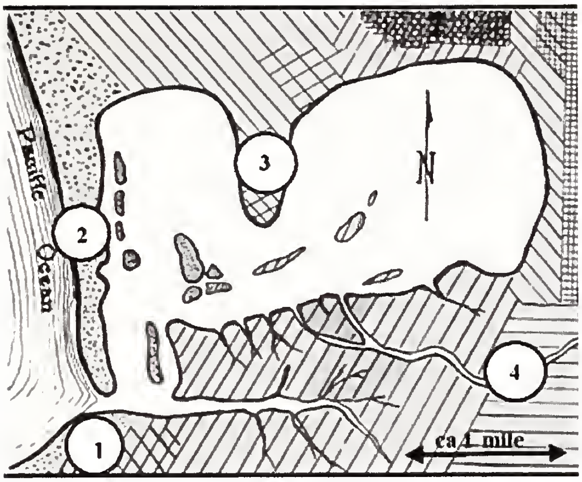

Figure 1. Mission Bay 1930, prior to development, adapted from Morrison (1930). (1) Ocean Beach, (2) Mission Beach, (3) Crown Point, (4) San Diego River.

Figure 2. Mission Bay 2011 landmarks. Large dark blue circles indicate the general location of the cove sampling sites (Channel, Mariner's Basin, Ventura Cove, Santa Clara Point, South Cove, Fiesta Island (Stony Point), and Ski Beach). Small pink circles are other locations visited during the survey.

a cross section of habitats. Sampling was typically conducted by walking the beaches or moving/then restoring rocks during minus tides. Micro shells were collected by washing the contents of rocks into a bucket. After the water was removed the contents were placed in a drying pan and examined with a dissecting scope. Deeper portions of the bay were surveyed by snorkeling and SCUBA diving. Shells that could not be identified via the literature were compared to material in reference collections.

The names of most gastropods used in the list of species are from *Marine Shells of Southern California* (McLean, 1978); *Taxonomic Atlas* Volume 9 (McLean & Gosliner 1996); *The Light and Smith Manual Intertidal Invertebrates from Central California to Oregon* (edited by Carlton, 2007); and bivalve names are from *Bivalve Seashells of Western North America* (Coan et al., 2000). Opisthobranch names are those used in *A Guide to the Opisthobranchs from Alaska to Central America* (Behrens & Hermosillo, 2005).

These publications are well documented and illustrated and should continue to be available at public and institutional libraries. Abbott (1974) and Keen (1978) were used for species not addressed by McLean (1978). For tracking old names and changes, Abbott (1954), Hall & Tompkins (1957), Morris (1966), Keep (1904), and Oldroyd (1927), were useful.

Finding old but relevant literature can be difficult due to generic and species name changes. A summary of gastropod name changes, as used in current literature, is as follows:

- *Acanthina* now *Acanthinucella spirata*
- *Acanthina* now *Mexicanthina lugubris*
- *Astraea* now *Pomaulax gibberosa, P. undosa*
- *Bursa californica* now *Crossata ventricosa*
- *Bittium* now *Lirobittium*
- *Lamellaria sharonae* now *Marseniopsis sharonae*
- *Nassarius fossatus* now *Caesia fossatus*
- *Nassarius* now *Hima perpinguis, H. mendicus, H. tegula*
- *Ocenebra* now *Ocinebrina*
- *Olivella* now *Callianax baetica, C. biplicata*
- *Polinices altus* now *Glossaulax altus, G. reclusianus*
- *Polinices lewisii* now *Euspira lewisii*
- *Tegula* now *Chlorostoma aureotincta, C. funebralis, C. gallina*
- *Tegula eiseni* now *Agathistoma eiseni*
- *Tegula regina* now *Stearnsium reginum*

Results/Discussion

The discussion is divided into two sections. First the current survey is discussed, followed by a comparison to past surveys conducted in Mission Bay.

Current Survey.

187 species of mollusks were identified, these included:

- 1 Cephalopoda
- 6 Polyplacophora
- 60 Bivalvia
- 120 Gastropoda [23 opisthobranchs, 15 limpets, 82 other snails].

Table 1 identifies the species and the habitat/substrate within which they were most commonly associated, their relative abundance, and if they were found intertidally and/or subtidally.

Roughly 26% of the opisthobranchs, 78% of all limpet types, 100% of the chitons, 72% of all other gastropods, and 71% of the bivalves may be found in the intertidal zone. The remainder of the animals were found subtidally while snorkeling or SCUBA diving. Large shells such as *Forreria belcheri* (Hinds, 1844), *Euspira lewisii* (Gould, 1847), *Kelletia kelletii* (Forbes, 1852), and mature *Trachycardium quadragenarium* (Conrad, 1937) do not wash ashore as the slopes are generally too steep.

The greatest diversity occurred in the two most complex habitats, the channel/jetty and Fiesta Island, each with 100-106 species. Outer coves such as Ventura and Mariner's Basin were next with 93 and 65 species. The two locations with the lowest diversity (circa 45 species) were Santa Clara Point and Ski Beach; both sites are inner bay beaches. Their exposed shore is mostly sand or sediment with a few river rocks.

As indicated in Figure 2, over twenty other locations in the bay were visited and although they confirmed the species composition only one unique species was found at these locations. These observations suggest that the targeted sites were very representative of the bay fauna.

Comments on Mission Bay Mollusks. Some species generally thought to be locally common were scarce during the survey; the most notable were: *Rictaxis punctocaelatus* (Carpenter, 1864), *Acteocina culcitella* (Gould, 1853) and *Turcica caffea* (Gabb, 1865) with only one individual of each found. Other species present in Mission Bay, during the 1950s—1970s were not found; these included: four species of *Calliostoma* and the large limpet relative *Diodora aspera* (Rathke, 1833). The *Turcica*, *Calliostoma* and *Diodora* are currently found off shore. Some of the many possible reasons for their

absence may include cyclical population fluctuations, water quality or water temperature. Summer water temperatures in the shallow portions of Mission Bay commonly exceed 76°F and during the summer of 2009 the dive thermometer registered 80° F near the surface along the jetty on an outgoing tide. In recent years winter temperatures have been 59-61°F. During the summer of 2010 inshore ocean water temperatures in Southern California were approximately 7-12°F lower than expected.

A number of gastropods and bivalves from the Panamic Province are present in Mission Bay, these include: *Anadara multicostata* (Sowerby, 1833), *Barbatia reeveana* d'Orbigny, 1848, *Pteria sterna* (A. Gould, 1851), *Spathochlamys vestalis* (Reeve, 1853), *Mitra fultoni* E.A. Smith, 1892, and *Mexicanthina lugubris* (Sowerby, 1821).

Barbatia reeveana and *Pteria sterna* are moderate to large shells. *Pteria sterna* are found in the outer coves among sand and eelgrass and easily found in shallow water when present. *Barbatia reeveana* is attached to rocks and covered with growth, making it difficult to find even when exposed at low tide (Tuskes, 2009).

The Ark Clam *Anadara multicostata* occurs in the outer coves on clean sand or sand-sediment bottoms from a depth of approximately 2 to 18 feet (Tuskes, 2008). Juvenile shells of this species are found in the debris field outside of octopus dens and large shells are used as mobile octopus dens. *Anadara tuberculosa* (Sowerby, 1833) has been found in the past (Hertz & Hertz, 1987) but was not located during this survey.

Mitra fultoni is scarce in Mission Bay and its habitat is the kelp bed that grows on the submerged jetty rocks. Underwater visibility ranges from 15 to 30 feet and there is notable surge. A number of moderate-sized black miters were observed each year, but only three were collected as all were assumed to be *Mitra idae* (Melvill, 1893) (Figure 3a). Sphon (1961) reviewed the distribution of *M. fultoni* in California and the Pacific coast of Mexico as well as the fossil record for this species. Keen (1971) and Abbott (1974) both illustrated *M. fultoni* and Abbott gave the range as San Diego to Panama. Compared to *Mitra idae*, *M. fultoni* is a smaller species, the shell is more curved and is inscribed with vertical and horizontal lines spaced 2 to 4 times further apart (forming squares), and the micro pits can be seen without the use of a hand lens (Figure 3b). For its size, the aperture of *M. fultoni* is larger than that of *Mitra idae*. The shell length of *M. idae* is typically given as 50-75 mm, the length of *M. fultoni* is 25-38 mm (Abbott, 1974). The specimen from Mission Bay measures 35.4 mm in length. A third miter matched the description of *M. catalinae* Dall, 1919 (Figure 3c & d). *Mitra catalinae* has been considered a juvenile of *M. idae* and treated as a synonym. West (1990, 1991) demonstrated that the two species are separate and has published morphological studies of both species.

In Mission Bay, *Mitra catalinae* involved in egg laying during January (2008-2011) measured 23 to 34 mm in length. This miter is very distinctive, the most prominent feature being its smooth vertical growth lines, small size, and the dark aperture area. Upon examination with a hand lens, a faint cancellated pattern on the shell can be seen. *Mitra fultoni* and *M. idae* have strong cancellated patterns from the first whorl to the aperture. *M. catalinae* were found intertidally (0 to-1.5 feet) on muddy sand and on or under rocks at Stony Point on Fiesta Island, Ventura Cove and South Cove on Vacation Isle. This environment is the antithesis of the oceanic habitat in the channel where *M. idae* and *M. fultoni* are found. Although none were observed while diving, it does not mean they were not present in deeper water. West (1991) found *M. idae* and *M. catalinae* sympatrically in the kelp beds off Pacific Grove and indicated that *M. catalinae* rarely exceeded 30 mm in length at that location. Based on the range of habitats used by *M. catalinae*, it appears to be an adaptable species.

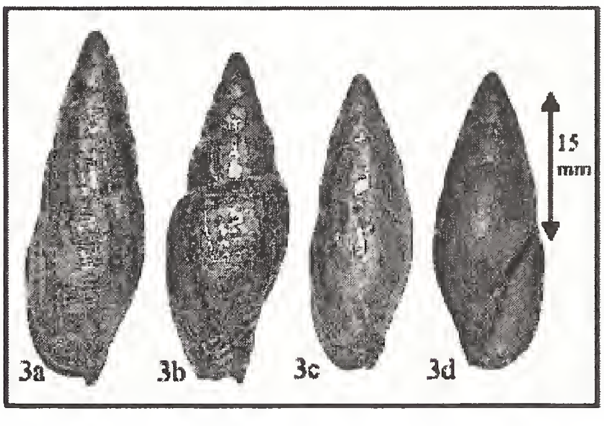

Figure 3 a-d. *Mitra* of Mission Bay (3a) *M. idae*, (3b) *M. fultoni* (3c,d) *M. catalinae*, dorsal and ventral surface.

A number of survey participants found varying sized fragments of the large egg cockle *Laevicardium elatum* (Sowerby, 1833). The local consensus is that this and other Panamic Province species sporadically colonize southern California and whether from changes in water temperature or inability to successfully reproduce, they

die out. *Laevicardium elatum* is probably not a resident at this time.

Local but uncommon gastropods such as *Crossata (Bursa) ventricosa* (Hinds, 1843), *Latiaxis oldroydi* (I. Oldroyd, 1929), *Neosimnia barbarensis* (Dall, 1882), *Stearnsium reginum* (Stearns, 1892), and *Forreria belcheri* were also found. Based on the Mission Bay population, Tuskes & Kelly (2008) published biological information and described host-parasite interaction between *Neosimnia barbarensis* and its sea pen host. *Forreria belcheri* are very mobile and will return to the same area to feed until the local population of clams or mussels are greatly reduced. On occasion large animals may be found on sand bottoms in shallow water during summer low tides. In late summer adults move into the channel, presumably to find deeper water and possibly move offshore. During the winter, adults are difficult to find or absent from the bay. Most specimens range in length from 120 to just under 170 mm. During the past four years adults have been found feeding consistently on the clam *Chione undatella* (Sowerby, 1835). *Forreria belcheri* has been reported from Mission Bay during surveys conducted in the late 1920s and the 1950s. Rescued specimens of this species were introduced to the Bay in the 1990s (Hertz & Hertz, 1995) prior to extensive dredging in San Pedro Harbor.

Five *Tegula* related species occur in the bay, all of which can be found intertidally. *Chlorostoma gallina* (Forbes, 1852) (Figure 4a & b) is scarce in the bay and the few specimens observed were *C. gallina* form *tincta* (Figure 4c & d) in South Cove. This form lacks the typical white axial markings and a gray ground color found on nominate *C. gallina*. The shell of form *tincta* ranges in color from gray-green to brown, often has an opalescent appearance where eroded, and seems to be slightly more elongate. I have not seen *tincta* illustrated or mentioned other than a brief line in Abbott (1974), and Oldroyd (1927) provided a drawing which is not diagnostic. This form is common on the nearby rocky coast where it occurs with typical *C. gallina* and *C. funebralis* (A. Adams, 1855) (Figure 4e & f). A few juvenile *Stearnsium reginum* were observed on minus tides. Mature *S. reginum* were seen while diving and exhibit a great deal of variation in color. *Agathistoma eiseni* Jordan, 1936, is currently the most common species in Mission Bay, followed by *C. aureotincta* (Forbes, 1853), *C. funebralis*, *S. reginum* and *C. gallina*.

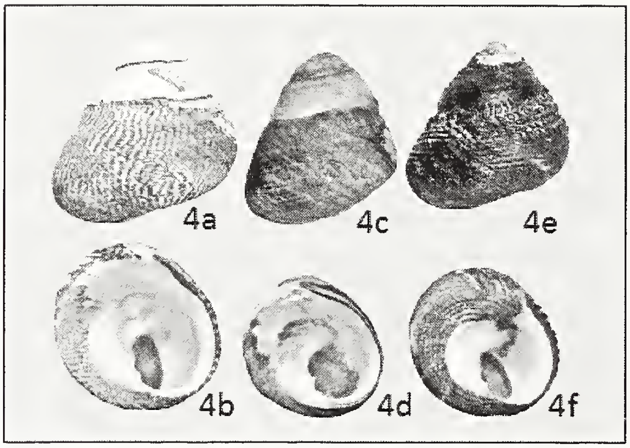

Figure 4 a-f. (a & b) *Chlorostoma gallina* (c & d) *C. gallina* form *tincta* (e & f) *C. funebralis*.

Table 1. Mollusks of Mission Bay, San Diego

Habitat: B = Bay beaches (Santa Clara, Ski Beach, Fiesta Island); C = Channel & Jetty; CV = Coves (Ventura, Quivira, South, Mariner's)
Substrates: EG = eelgrass; S = sand; K = kelp; SD = sediment; R = rock; SH = shell
Depth: IT = intertidal (-1.5 to +5 ft); ST = subtidal (-1.5 to -30 ft)
Abundance: S = scarce = found 1-2/year; UC = uncommon = found 3-6/year; C = common = likely to be found; A = abundant = numerous observations/visits

Name	Habitat	Substrate	Depth	Abundance
Cephalopoda				
Octopus bimaculoides	ALL	ALL	IT-ST	C
Opisthobranchia				
Acteocina culcitella	B-CV	S	ST	S

Table 1 continued

Names	Habitat	Substrate	Depth	Abundance
Aplysia californica	B-CV	S-R-EG	ST	C
Aplysia vaccaria	C	R	ST	C
Armina californica	C	S	ST	UC
Baptodoris mimetica	C-CV	S-R	ST	S
Bulla gouldiana	B-CV	S-EG	ST-IT	A
Chromodoris macfarlandi	C	R	ST	C
Corambe pacifica	C-CV	K	ST	UC
Diaulaula sandiegensis	C	R	ST	UC
Doriopsila albopunctata	C-CV	S	ST	C
Doriopsila gemela	C	R	ST	UC
Doris montereyensis	C-CV	R-S	ST	C
Doris tanya	C	R	ST	S
Eubranchus steinbecki	B	S	ST	C
Flabellina iodinea	C	R	ST	C
Flabellina trilineata	C	R	ST	UC
Haminoea vesicula	B	S	ST-IT	C
Haminoea virescens	C-CV	R-S	ST-IT	C
Hermissenda crassicornis	C	R	IT	UC
Limacia cockerella	C	R	ST	C
Navanax inermis	ALL	S-R-EG	ST-IT	C
Rictaxis punctocaelatus	CV	S	ST-IT	S
Tylodina fungina	C	R	ST	UC
Gastropoda (All Limpets)				
Fissurella volcano	C	R	IT-ST	A
Lottia asmi	C-CV	SH-R	IT	UC
Lottia conus	C-CV	R	IT	C
Lottia depicta	CV	EG	ST-IT	A
Lottia digitalis	C	R	IT	UC
Lottia gigantea	C	R	IT	C
Lottia insessa	C	K	ST	A
Lottia limatula	C-CV	R	IT	A
Lottia ochracea	C	R	ST-IT	UC
Lottia paleacea	C	EG	ST-IT	C
Lottia scabra	C-CV	R	IT	A
Lottia strigatella	C-CV	R	IT	UC
Lucapinella callomarginata	CV-B	R	ST-IT	UC
Megatabennis bimaculatus	CV-B	R	ST-IT	S
Megathura crenulata	C	R	ST-IT	A
Other Gastropoda				
Acanthinucella spirata	C-CV	R	IT	C
Agathistoma eiseni	ALL	R	IT-ST	A
Amphissa versicolor	B	S-R	IT-ST	UC
Assiminea californica	B-CV	R	IT-ST	C

Table 1 continued

Names	Habitat	Substrate	Depth	Abundance
Caecum californicum	ALL	R	IT-ST	C
Caesia fossatus	CV	S	ST	UC
Callianax baetica	CV	S	IT	A
Callianax biplicata	ALL	S	IT-ST	A
Ceratostoma nuttalli	C	R	IT-ST	A
Cerithidea californica	B	S-SD	IT	A
Cerithiopsis carpenteri	ALL	R	IT-ST	C
Conus californicus	C-CV	R-S	IT-ST	A
Chlorostoma aureotincta	ALL	R	IT-ST	C
Chlorostoma funebralis	C-CV	R	IT-ST	C
Chlorostoma gallina	CV	R	IT	UC
Crassispira semiinflata	C	S-R	ST	UC
Crepidula coei	C-CV	SH-R	IT-ST	C
Crepidula norrisiarum	CV-B	SH-R	IT	A
Crepidula onyx	CV-B	R	IT	A
Crepidula perforans	CV	R	IT	UC
Crepipatella lingulata	CV-B	SH-R	IT-ST	UC
Crossata ventricosa	C	S-R	ST	UC
Crucibulum spinosum	C-CV	SH	IT-ST	C
Cypraea spadicea	C	R	ST	C
Dendropoma lituella	ALL	R	IT	C
Epitonium tinctum	ALL	R-S	IT-ST	C
Erato columbella	C-CV	R-S	IT	UC
Erato vitellina	CV-B	R	IT	UC
Euspira lewisii	C-CV	S	ST	UC
Forreria belcheri	C-CV	S	ST	UC
Glossaulax altus	C-CV	S-EG	ST	S
Glossaulax recluzianus	C-CV	S-EG	ST-IT	C
Granulina subtrigona	CV	R	IT-ST	UC
Haliotis corrugata	C	R	ST	UC
Haliotis cracherodii	C	R	ST	S
Haliotis fulgens	C	R	ST	C
Hima mendicus	CV-B	S-SD	IT-ST	C
Hima perpinguis	CV-B	S-SD	IT-ST	UC
Hima tegula	CV-B	S	IT-ST	A
Homalopoma luridum	C	R	ST	S
Kelletia kelletii	C-CV	R-S	ST	A
Lacuna unifasciata	CV-B	S-SD	IT	UC
Lamellaria diegoensis	C-CV	R-S	IT-ST	UC
Latiaxis oldroydi	C	R	ST	S
Lirularia acuticostata	CV	R	IT	UC
Lirobittium purpureum	ALL	R	IT-ST	C

Table 1 continued

Names	Habitat	Substrate	Depth	Abundance
Littorina planaxis	ALL	R	IT	A
Littorina scutulata	ALL	R	IT	A
Lirobittium quadrifilatum	ALL	R	IT-ST	C
Marseniopsis sharonae	C-CV	R	ST	S
Maxwellia gemma	C	R	ST	UC
Melampus olivaceus	B	SD	IT	C
Mexacanthina lugubris	C	R	IT	C
Mitra catalinae	B	SD-R	IT	C
Mitra fultoni	C	R	ST	S
Mitra idae	C	R-S	ST	S
Mitrella aurantiaca	CV	EG	ST	A
Mitrella tuberosa	C-CV	R-EG	ST	UC
Norrisia norrisi	C-CV	R-K	IT-ST	C
Ocenebrina beta	C	R	ST	S
Ocenebrina gracillima	C-CV	R	IT	UC
Opalia funiculata	B	S-SD	IT	C
Ophiodermella ophioderma	ALL	S-R	IT-ST	C
Pedipes unisulcatus	ALL	R	IT	UC
Petaloconchus montereyensis	CV	SH	IT	UC
Pomaulax gibberosa	CV-B	S	IT-ST	S
Pomaulax undosa	C-CV	R-S	IT-ST	A
Pseudomelatoma penicillata	ALL	S-R	IT-ST	C
Pteropurpura festiva	ALL	R-S	IT-ST	A
Pteropurpura trialata	ALL	R	IT-ST	C
Pyramidella adamsi	ALL	R	IT-ST	V
Roperia poulsoni	ALL	R-S	IT-ST	A
Serpulorbis squamigerus	ALL	R	IT-ST	A
Simnia barbarensis	C	S	ST	UC
Sinum scopulosum	C	S	ST	S
Stearnsium reginum	C	R	ST	UC
Terebra pedroana	C	S	ST	S
Trivia californiana	ALL	R	IT-ST	C
Trivia solandri	C-CV	R	IT-ST	C
Turbonilla tenuicula	C-CV	R	IT-ST	C
Turcica caffea	C	R	IT-ST	S
Volvarina taeniolata	ALL	R	IT-ST	C
Polyplacophora				
Callistochiton decoratus	CV	R	IT	UC
Cyanoplax hartwegii	ALL	R	IT	A
Lepidozona pectinulata	B-CV	R	IT	C
Mopalia muscosa	B-CV	R	IT	UC
Nuttalina fluxa	B-CV	R	IT	C

Table 1 continued

Names	Habitat	Substrate	Depth	Abundance
Stenoplax conspicua	B-CV	R	IT	A
Bivalvia				
Amiantis callosa	C-CV	S	IT-ST	S
Anadara multicostata	CV	S	ST	UC
Argopecten ventricosus	CV-B	S-SD	IT-ST	A
Barbatia reeveana	CV-B	R	IT	S
Chama arcana	C-CV	R	IT-ST	UC
Chione californiensis	CV-B	S-SD	IT-ST	A
Chione fluctafraga	B	S-SD	IT-ST	A
Chione undatella	CV-B	S-SD	IT-ST	A
Crassadoma giganatea	C-CV	R	IT-ST	A
Crassostrea gigas	CV-B	R	IT	A
Cryptomya californica	C-CV	S-SD	IT-ST	UC
Cumingia californica	C	S	ST	UC
Diplodonta orbellus	C-CV	R	IT-ST	C
Donax californicus	CV	S	IT	UC
Donax gouldii	CV	S	IT	A
Entodesma navicula	C-CV	Sponge	IT-ST	C
Epilucina californica	CV	S-R	ST	UC
Gari californica	C-CV	S	ST	UC
Heterodonax pacificus	C-CV	S	ST	UC
Laevicardium elatum	Only broken shells			
Laevicardium substriatum	CV-B	S-SD	IT-ST	S
Leporimetis obesa	ALL	S-SD	IT-ST	C
Leptopecten latiauratus	CV	EG	ST	A
Lima hemphilli	C	R	ST	C
Lyonsia californica	CV-B	S	IT-ST	UC
Macoma indentata	C	S	IT-ST	C
Macoma nasuta	ALL	S-SD	IT-ST	C
Macoma secta	C	S	ST	C
Mactrotoma californica	C-CV	S	ST	UC
Mactrotoma nasuta	C-CV	S	ST	C
Mactromeris hemphilli	C-CV	S	ST	UC
Modiolus capax	CV	R	IT-ST	UC
Modiolus neglectus	CV	R	IT-ST	UC
Musculista senhousia	CV	S-SD	IT-ST	C
Mytilus californianus	ALL	R	IT	C
Mytilus galloprovincialis	ALL	R	IT	A
Nuttallia nuttallii	C-CV	S	ST	C
Ostrea lurida	B	SH-R	IT	C
Periploma planiusculum	C-CF	S	IT-ST	C
Pododesmus cepio	CV-B	R	IT	UC

Table 1 continued

Names	Habitat	Substrate	Depth	Abundance
Protothaca laciniata	CV	S	IT-ST	C
Protothaca staminea	CV	S-SD	IT-ST	C
Protothaca tenerrima	CV	S	IT	UC
Pseudochama exogyra	C-CV	R	IT-STR	C
Pteria sterna	CV	S	ST	S
Saxidomus nuttalli	C-CV	S	IT-ST	A
Semele decisa	C	S	IT-ST	C
Semele rupicola	C-CV	R-S	IT-ST	C
Solen rosaceus	C-CV-B	S-SD	IT-ST	C
Spathochlamys vestalis	B	S	IT	S
Tagelus californianus	CV	S-SD	IT-ST	A
Tagelus subteres	CV	S-SD	IT-ST	A
Tellina idae	CV	S-SD	ST	UC
Tellina meropsis	C-CV	S	IT-ST	UC
Tellina modesta	C-CV	S	IT-ST	C
Tivela stultorum	C-B	S	ST	UC
Trachycardium quadragenarium	C-CV	S-SD	ST	C
Tresus nuttallii	C-CV	S	IT-ST	C
Venerupis philippinarum	CV-B	S	IT	C

Comparison to Past Surveys Charles Orcutt (1885) published a list of mollusks from San Diego to Todo Santos Bay in Mexico and included records for False Bay. Morrison (1930), as part of his thesis requirements at the University of Southern California conducted the first detailed survey of Mission Bay in 1928 and 1929. The study is significant as it is the only comprehensive survey (nearly 15 years) prior to the development of Mission Bay. The next survey of Mission Bay mollusks was by Farrar & Morrison (1953) followed by Rohlf (1958). Table 2. compares the relative number of mollusks found in the past and present surveys.

Comparing the results of the present survey to those in the past has been made difficult due to the chronic change in both generic and species names. Tracking down synonymies is a painstaking task. The number of species reported in previous surveys (Table 2) is actually fewer than reported in their publication, since various species with distinctive forms have more recently been recognized as single species. Some identifications, especially for bivalves and nudibranchs are questionable, as many were described in the literature but not illustrated, or were presented in lithographs which may lack sufficient detail.

Table 2. Relative number of mollusks reported in each comprehensive survey of Mission Bay.

Survey	Total Mollusks	Limpets (all types)	Opisthobranchs	Other Gastropods	Bivalves	Chitons
Morrison, 1930	148	13	13	56	63	3
Farrar & Morrison, 1953	107	10	9	40	44	4
Rohlf, 1958	119	13	24	47	32	3
Current Survey, 2010	187	15	23	83	60	6

Morrison (1930) identified 148 species of mollusks prior to the start of dredging in 1946. The bay had extensive tidal flats and shallows and 63 species of bivalves (by current standards) were found prior to development. Morrison and Farrar surveyed the bay again in 1953, three years after the completion of the initial Mission Bay development project and reported 41 fewer species. With the exception of chitons, all categories in the 1953 survey demonstrated 25-30% fewer species. When the impact of dredging 25 million cubic yards of sand-sediment to deepen and reshape the bay is taken into consideration, this finding is expected.

Although the total number of mollusks in the 1953 and 1958 surveys was similar, the composition made a notable shift. The 1958 survey reported fewer bivalves, but an increase in all types of gastropods, especially opisthobranchs. In early 1953, rock associated with the jetties and channel had been submerged approximately two years and not yet fully colonized. By 1958 the survey identified many species of gastropods associated almost exclusively with hard substrate, such as various species of *Haliotis*, *Megathura*, *Erato*, and numerous opisthobranchs.

The current survey found approximately 40% more mollusks than Farrar & Morrison (1953) and Rohlf (1958). Catch per unit effort cannot be used to compare results as none of the surveys documented time in the field or methods. A reasonable question might be, has species diversity increased since the work of Rohlf (1958)? The answer is, probably not if the assumption that neither snorkeling nor diving were methods used by Rohlf. If that is correct, the higher species count in this survey is due to the extensive diving that allowed access to the deeper portions of Mission Bay. The current survey identified 128 intertidal species and that number is similar to Farrar & Morrison (1953) with 107 species and Rohlf (1958) 119 species. The additional 59 subtidal species found while diving (32% of total), accounted for most of the 37% increase in the number of species over past surveys.

Hertz (1974) surveyed Quivira Basin during low tides and identified 71 species. Quivira Basin is the most protected of the outer coves and the only cove that is completely ringed with rip-rap. Currently, the cove has the largest population of moored pleasure craft. Although Quivira Basin was not a targeted site, it was visited numerous times and I have the impression that mollusk diversity has decreased in the past 35 years.

The addition of miles of submerged rip-rap during the development of the channel and bay has created an extensive and diverse community of macro-algae and invertebrates. The gastropods have benefitted from this change with a significantly greater number of species found than in the past. The negative impact of the initial dredging on the bivalves appeared to have been severe. Currently bivalve diversity is similar to levels prior to the development of Mission Bay. Although mollusk diversity within the bay is high, there has been a shift in species composition.

Species reported in prior surveys, but not found during the current survey are identified in Table 3. Many of these species occur in the San Diego area, and in some cases are found a few miles north or south of Mission Bay. Species living at the edge of their range appear, disappear and reappear when conditions permit. The absence of species that might otherwise be expected is most likely the result of population shifts/fluctuations or sampling methods/errors. In a few instances, the species reported in past surveys may have been misidentified.

The data presented in this paper are the collective efforts of many members of the San Diego Shell Club who participated in this survey. No survey can expect to find all species within such diverse and expansive habitats. Mission Bay has approximately 27 miles of shoreline and the Park encompasses 4,600 acres. The fact that some well-known and common species (according to the literature) were not found, simply suggests they were not common during this survey. Approximately 51 species reported in past surveys were not found during the present effort. The scope of the current survey was sufficient to conclude that the species listed in Table 3 are currently exceedingly uncommon or absent at this time from Mission Bay. Collectively over 240 species of mollusks have been reported from Mission Bay since 1930.

Collecting live shells, opisthobranchs, etc., in California requires a valid California fishing license and a knowledge of the regulations. Be respectful of the animals and environment. The Mission Bay Park and Lifeguard Service have regulations that address boating, diving, swimming, and beach/park use. Diving along the jetty west of Ventura Bridge is permitted if you do not enter the channel. Diving east of the Ventura Bridge is permitted only in designated swimming areas. Because of boat traffic, diving elsewhere requires notification and permission from the Lifeguard Service and the use of a dive flag.

Table 3. Mollusks reported in past surveys that were not found during the current survey.

Name	Morrison, 1930	Farrar & Morrison, 1953	Rohlf. 1958	Hertz, 1975
Opisthobranchia				
Acanthodoris rhodoceras		X		
Acteocina inculta			X	
Dirona picta			X	
Janolus barbarensis			X	
Okenia rosacea		X		
Peltodoris nobilis			X	X
Rostanga pulchra			X	
Trapania velox			X	
Gastropoda (all limpets)				
Acmaea pelta		X		X
Acmaea persona		X		
Acmaea scutum	X	X	X	
Acmaea mitra	X			
Diodora arnoldi	X			
Diodora aspera	X	X		X
Other Gastropoda				
Amphissa reticulata	X			
Calliostoma gloriosum				X
Calliostoma ligatum			X	
Calliostoma supragranosum				X
Calliostoma tricolor		X		
Crassispira rustica			X	
Granulina margaritula			X	
Hipponix antiquatus	X			
Hipponix tumens	X	X		
Homalopoma carpenteri		X		
Homalopoma baculum			X	
Kurtziella plumbea		X		
Janthina exigua	X			
Macron lividus	X			
Nassarius cooperi	X			
Phasianella compta		X		
Ocenebra lurida			X	
Trimusculus reticulatus	X			
Turbonilla stylina	X			
Bivalvia				
Chama hastatus	X		X	
Cooperella subdiaphana		X		

Table 3 continued

Name	Morrison, 1930	Farrar & Morrison, 1953	Rohlf. 1958	Hertz, 1975
Hiatella arctica			X	X
Kellia suborbicularis	X			
Lasaea adansoni				X
Lithophaga plumula			X	
Lucina nuttalli		X		
Simomactra planulata		X		
Penitella penita	X			
Petricola californiensis	X			
Petricola carditoides	X			
Pododesmus macrochisma			X	
Semele pulchra	X			
Septifer bifurcatus	X	X		
Siliqua lucida		X		
Tellina carpenteri	X	X		
Zirfaea pilsbryi	X	X	X	

Plate 1 illustrates some of the limpets and chitons that are variable in pattern or appearance and may be confused with related species. Among the chitons found in Mission Bay, *Cyanoplax hartwegii* (Carpenter, 1855) and *Nuttallina fluxa* (Carpenter, 1864) are variable in both color and pattern. Also illustrated are the Triividae, some shelled opisthobranchs, live animals and additional uncommon species.

Plate 2 illustrates a cross section of gastropods and bivalves from Mission Bay. Most of the bivalves were selected because they are readily found. *Protothaca staminea* (Conrad, 1837) is typically white, but some specimens have purple to brown markings which cause them to be confused with *Venerupis philippinarum* (A. Adams & Reeve, 1850).

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Plate 1. (Approximately life size unless indicated) 1 *Haminoea virescens*. 2 (3x)*Volvarina taeniolata*. 3 (3x) *Erato columbella*. 4 *E. vitellina*. 5 (2x) *Trivia californiana*. 6 (1/2x) *Lucapinella callomarginata*. 7 *Haminoea vesicula*. 8a-b *H. virescens*. 9 *Acteocina culcitella*. 10 *Rictaxis punctocaelatus*. 11 *Ocenebra beta*. 12 *Trivia solandri*. 13 *T. californiana*. 14 *Erato vitellina*. 15 (2x) *E. columbella*. 16 *Simnia barbarensis*. 17a-b *Lottia gigantea*. 18a-c *L. limatula*. 19a-b *L. digitalis*. 20a-c *L. conus*. 21 *L. insessa*. 22 *L. asmi*. 23 *L. strigatella*. 24a-c *L. scabra*. 25 *Megatebennus bimaculatus*. 26 *Lucapinella callomarginata*. 27a-b *Fissurella volcano*. 28 *Cyanoplax hartwegii*. 29 *Nuttallina fluxa*. 30 *Callistochiton decoratus*. 31 *Lepidozona pectinulata*. 32 *Mopalia muscosa*. 33 *Stenoplax conspicua*.

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Plate 2. 1 & 2 (4x) *Alia carinata*. 3 (4x) *Pedipes unisulcatus*. 4 (3x) *Epitonium tinctum*. 5 *Opalia funiculata*. 6 (3x) *Lirobittium purpureum*. 7 (3x) *Lirobittium quadrifilatum*. 8 (3x) *Turbonilla tenuicula*. 9a-b (3x) *Volvarina taeniolata*. 10 *Lamellaria diegoensis*. 11 *Marseniopsis sharonae*. 12 *Spathochlamys vestalis*. 13 *Caesia fossatus*. 14 *Hima perginguis*. 15 *H. tegula*. 16 *H. mendicus*. 17a-b *Amphissa versicolor*. 18a-b *Terebra danai*. 19 *Pseudomelatoma penicillata*. 20 *Ophiodermella ophioderma*. 21 *Latiaxis oldroydi*. [Figs 22-34: 1/2x] 22 *Chione fluctifraga*. 23 *C. californiensis*. 24 *C. undatella*. 25 *Protothaca laciniata*. 26 *P. staminea*. 27 *Mactrotoma californica*. 28 *Macoma secta*. 29 *M. nasuta*. 30 *Chama arcana*. 31 *Venerupis philippinarum*. 32 *Semele decisa*. 33 *Argopecten ventricosus*. 34 *Gari californica*. 35 *Lyonsia californica*. 36 *Donax gouldii*. 37 *Donax californicus*. 38 (1/2 x) *Leporimetis obesa*. 39 (1/2x) *Nuttallia nuttallii*. 40 (1/3x) *Pteria sterna*. 41 *Laevicardium substriatum*. 42 (1/3x) *Trachycardium quadragenarium*.

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(Other than those in Tuskes, 2012)

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This list was originally created as a working reference in support of The San Diego Shell Club's project on Mission Bay. Later it was determined that some of these "hard to find" references specifically for Mission Bay might be useful for future researchers on Mission Bay and it was decided to publish those findings here.

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5(2): [Pacific Shell Club] P6-7 (March). Sightseeing, anyone? By Twila Bratcher. [*Murex festivus, Megathura crenulata, Astraea undosa, Ocenebra paulsoni* (sic) *poulsoni*, octopus lair]
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#25: (July) 12. Tellinidae.[*Tellina carpenteri* Dall, 1900]

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#32: (February) 10. By William K. Emerson. [*Mangilia hamata* (live) and *Hyalina californica* (dead) & *Murex trialatus* in Mission Bay. Emerson states "never found the *Mangilia* there or any other place…not in Mr. Morrison's or Miss Wilson's list of shells collected in Mission Bay … none in the San Diego Natural History Museum."]

#40: 19-20. *[Lasaea rubra*]; 24. [*Chlamydoconcha orcutti*]

#41: (November) 25. [*Trigoniocardia (Americardia) biangulata*] 26. [*Laevicardium substriatum*]

#42:(December) 9. [*Chione fluctifraga; Chione undatella*]

1945. #43: (January) 10 [*Scrobicularia biangulata*] 17. [*Semele decisa*] 20. [*Donax californicus*] 23. [*Tagelus subteres; Tagelus californianus*]

#48: (May) 4.[*Haminoea virescens* "common" (Emerson); *Haminoea vesicula* "uncommon" (Emerson) 18. *Terebra pedroana*]

#51: (August) 8. [*Nassarius mendicus cooperi* 35. *Pteropurpura trialata* 36. *Pteropurpura festiva* 44. *Ceratostoma nuttalli* 47. *Ocenebra poulsoni* 54. *Forreria belcheri*]

#54: (November) 14. [*Cerithiopsis carpenteri* (on sponge) 15. *Cerithiopsis pedroana* (on yellow sponge) 31. *Bittium quadrifilatum* (common, eelgrass) 32. *Bittium interfossa* "rare in Mission Bay" (Emerson)]

#55: (December) 15. [*Lacuna unifasciata* 21. *Barleeia subtenuis* 33. *Alvania pedroana*]

1946.

#56: (January) 7. [*Acmea stimpsoni* 21. *Crucibulum spinosum* 30. *Polinices lewisii (Polinices recluzianus)*"all estuaries in southern California…") 32. *Sinum scopulosum*]

#57: (February) 2.[*Lamellaria stearnsii*; *Lamellaria diegoensis*]

#60 (May) 25.[*Lucapinella callomarginata* 26. *Diodora aspersa*]

#61: (July) 20. [*Pyramidella adamsi* 21. *Peristichia pedroana* 22. *Turbonilla diegensis* 25. *Turbonilla buttoni* 34. *Turbonilla tridentata*; *Turbonilla laminata* 37. *Odostomia helga* 40. *Odostomia fetella*]

#62 (August) 30. [*Cytharella merita*]

1952.

#122 (September) 3-7 with map. An ecological study of mollusks found at Mission Bay, San Diego, Calif. By Roy Morrison. [Condensed from a paper given at the Fiftieth Annual Meeting of the AMU]

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THE FESTIVUS

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Meeting date: third Thursday, 7:30 PM,
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PROGRAM

Bivalves of Tropical West America

Eugene Coan and Paul Valentich-Scott, the authors of the new and extensive book on Tropical West American bivalves, will make a presentation on their research as well as new taxa and taxonomic innovations treated in their new book. Attendees will be able to examine and/or order the book (which can be signed) at the meeting.

This will be a special event complete with hors d'oeuvres, beverages, desserts and socializing to start at 7:00 PM in honor of the guest speakers. It will be necessary to RSVP if you plan to attend.

Meeting date: March 15, 2012

CONTENTS

Club news 34
The opisthobranch fauna of Isla Guadalupe, Mexican Pacific
ALICIA HERMOSILLO & CAROLE M. HERTZ 35
Book news: Russian Opisthobranchs (reviewed)
HANS BERTSCH, reviewer 40

CLUB NEWS

San Diego Shell Club Minutes
13 February 2012

The meeting was called to order at 7:35 PM by President Bob Dees. The previous minutes were approved and the Treasurer's report was accepted. Carole Hertz reminded members that *The Festivus* is looking for papers.

The meeting in March will celebrate two events. The Hertzes will received the first award from the SDSC for Lifetime Contributions to Conchology or Malacology. Secondly, Eugene Coan and Paul Valentich-Scott will discuss and present their new book on the *Bivalve Seashells of Tropical West America*. There will be good food and company so be sure to RSVP to David Waller at dwaller@dbwipmg.com

Paul Tuskes presented an overview of the Mission Bay Survey which was published in the February issue of *The Festivus*. The presentation included underwater photos of many gastropods and bivalves and the various marine habitats, both above and below water. Of the 187 species found, only three were introduced species (*Venerupis philippinarum, Crassadoma gigantea* and *Musculista senhousia)* all bivalves. The Panamic species that occur in the bay were illustrated and discussed. The survey work published by Morrison in 1930 provided an excellent baseline of Mission Bay prior to its development. Over the past 70 years the number of bivalve species has returned to pre-development levels. Gastropods, on the other hand, have benefitted from the miles of large rock deposited on the jetties and channel to prevent erosion. This hard substrate has provided habitat for oceanic algae, large numbers of marine worms, echinoderms, crustaceans, and gorgonian corals. As such, 120 non-bivalve mollusks were found in the current study vs a maximum of 85 species in 1930. This project was the cooperative effort of many San Diego Shell Club members. For more details, see the article in the February issue.

The door prize was won by Don Smith, the refreshments brought in by Bob Dees and Wes Farmer.

Paul Tuskes

A Special Meeting in March

The March meeting will be an exciting and special one. Paul Valentich-Scott and Eugene Coan have authored a new two volume work on the bivalves of the Panamic Province with all illustrations in color. The two authors, who are longtime members of the Club, will give a program discussing different aspects of the books and will be available for questions.

They will be bringing books for members to view and will take orders for any that attendees wish to buy. The authors are willing to autograph books for those who might wish it.

The evening's event will begin at 7 PM. Instead of our usual "Coffee Time," The Club will be providing hors d'oeuvres and beverages in addition to coffee, and desserts. It will be party time and an exciting program for all. Please plan to attend and welcome Paul and Gene.

The Club asks that you RSVP to Vice President Dave Waller at <dwaller@dbwipmg.com> by March 12th if you plan to attend this special event.

TO ALL OUR SHELLING FRIENDS

The San Diego Shell Club's annual auction/potluck will be held on Saturday evening April 4th in the community room of Wes Farmer's condo at 3591 Ruffin Rd., San Diego, CA. The festivities will begin at 5 P.M. with "Dave's Punch",wine, and soft drinks while you view the auction tables. Dinner will be at 6 P.M. sharp and the voice auction will begin promptly at 7 P.M.

Among some of the very special items for auction are a number of excellent books and many beautiful shells. Among them are *Strombus thersites* and *helli,* many great cowries like *Cypraea bregeriana pervalata, rashleighana, mappa eluceta, armeniaca, oweni, oceanica,* and, *melwardi,* outstanding cones, marginellas and muricids such as *Pteropurpura centrifuga, Murex elliscrossi, Chicomuex superbus, Siratus venustulus* (banded), *Pterynotus pinniger,* and *Naquetia annandalei*. There will also be some large, showy shells such as *Charonia tritonis* (± 380 mm) and *Chicoreus ramosus* (± 235 nn). Besides the voice auction, there will be a huge,wonderful silent auction and enormous $1 table.

If you are unable to attend the auction and want to be a part of it, you can request an auction list by e-mailing jhertz@san.rr.com and a list will be sent to you. Should you wish to bid on any items, an attending Club member will bid for you following your instructions. If you plan to attend, please contact Carole or Jules Hertz at (858) 277-6259 or at the e-mail address above. You can bring either a main course, salad, or dessert to serve 12.

THE OPISTHOBRANCH FAUNA OF ISLA GUADALUPE, MEXICAN PACIFIC

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Abstract: This paper reports 31 additional species of opisthobranchs from Isla Guadalupe, where only ten species had previously been reported for a total of 41. The vast majority of these species are known from elsewhere along the California coast or Pacific coast of México, with 36.8% of Temperate and 50% of Temperate-Panamic affinity. This is the southernmost report for four species: *Dendrodoris behrensi*, *Cadlina sparsa*, *Triopha maculata* and *Pleurobranchaea californica*. Only *Tritonia* sp. is possibly undescribed and endemic.
Keywords – Mollusca, Opisthobranchia, México, Oceanic Islands, Isla Guadalupe
Resumen
En este artículo reportamos 31 especies de opistobranquios adicionales a las 10 anteriormente conocidas para Isla Guadalupe. Esto da un total de 41. La gran mayoría de estas especies se conocen en otras áreas de la costa de California y el Pacífico mexicano, siendo 36.8% afines a la provincia templada y 50% a la templada-panámica. Este reporte es el extremo sur conocido en la distribución de cuatro especies: *Dendrodoris behrensi*, *Cadlina sparsa*, *Triopha maculata* y *Pleurobranchaea californica*. Solamente *Tritonia* sp. es posible endémica y no descrita.
Palabras clave – Mollusca, Opisthobranchia, México, Islas oceánicas, Isla Guadalupe

Introduction

The knowledge of the molluscan fauna of Isla Guadalupe is important. Although there are many publications on land, freshwater and marine mollusks of Isla Guadalupe, these reports include only a few additional opisthobranchs, none of the order Nudibranchia.

Strong & Hanna (1930) list 87 species of marine mollusks from specimens collected during the 1926 California Academy of Sciences Expedition. Nine of these mollusks were undescribed at the time. Only two were opisthobranchs: *Acteocina angustior* Baker & Hanna, 1927, and *Acteocina harpa* (Dall, 1917) as *Retusa harpa*. Strong (1954) increased the number of species to 116 based on a Scripps Institution of Oceanography Expedition in 1946. Talmadge (1964, 1966) described two subspecies from Guadalupe. But the most comprehensive list of mollusks from Isla Guadalupe was published by Chace (1958). He reported 193 species, 77 of which had not been previously known from Isla Guadalupe, including ten he considered endemic. His list contains a total of nine opisthobranchs, five not previously reported: *Tylodina fungina* Gabb, 1865, *Umbraculum umbraculum* (Lightfoot, 1786) as *Umbraculum ovale* (Carpenter, 1856), *Rictaxis punctocaelatus* (Carpenter, 1864) as *Acteon punctocaelata*, *Acteocina magdalenensis* Dall, 1919, and *Acteocina inculta* (Gould, 1855) as *Acteocina planulata* Gould, 1855. Bad weather conditions during the 1993 Cordell Expeditions to Rocas Alijos, gave collectors one

day of diving at Isla Guadalupe during which some mollusks were collected. Schmieder (1996) reported *Berthellina* sp. and *Navanax inermis* (Cooper, 1863). These two last species are the first non-shelled opisthobranchs published for Isla Guadalupe.

Some mollusks that have been described from specimens collected at Isla Guadalupe have been named in honor of this island. Dall (1990) named the terrestrial species *Epiphragmophora guadelupiana* and *Succinea rusticana guadelupensis*; Pilsbry (1927) reported on the land and freshwater mollusks of Guadalupe and named four species for the island. Berry (1957) described *Astraea guadalupeana*, (later found to be a synonym of *A. gibberosa*); Strong (1954) described *Rissoina guadalupensis* and *Glycymeris guadalupensis;* Talmadge (1964) named a new subspecies of *Haliotis* from Isla Guadalupe: *H. fulgens guadalupensis* and Ferreira (1978) named the chiton *Lepidozona guadalupensis*.

Materials and Methods

Surveys were conducted with SCUBA using the direct observation method. During a period of 11 years, a total of 15 days were spent searching for the species reported herein. Animals were observed and photographed during various expeditions to the Islands: June 1999 (3 days), July 2002 (4 days), July 2004 (4 days), October 2008 (2 days) and June 2010 (2 days). Only the lee side of the island, the southern islets and two sites on the weather side of the island were surveyed. Deep-water opisthobranchs were observed and documented from the submarine DeepSee during the 2008 Jatai Expedition by Manuel Lazcano, Mauricio Hoyos and Avi Kepfler.

Results and Discussion

A total of 31 species of opisthobranch mollusks is here added to those previously known from Isla Guadalupe. This extends the number of known taxa for the Island to 41 and contains the first nudibranchs reported for Isla Guadalupe. Table 1 lists the species of opisthobranch mollusks so far known for Isla Guadalupe. The second column includes the faunal province affinities of the species following Keen (1971): Temperate (California, Baja California to Bahía Magdalena) and Panamic (south of Bahía Magdalena, Golfo de California, Mexican Pacific). Species with overlapping known distributions are determined as Temperate-Panamic. For those species known in other oceans (i.e. Atlantic) it is so explained.

Isla Guadalupe (roughly latitude 28°N) is the southernmost locality reported for *Dendrodoris behrensi*, *Cadlina sparsa*, *Triopha maculata* and *Pleurobranchaea californica* (Behrens & Hermosillo, 2005). Only one species appears to be an undescribed *Tritonia*, which was observed from the DeepSee submarine at depths of about 100m. It was not collected; therefore it is not possible to know for certain whether it is an undescribed species or a color variation of an already described species. This is possibly the only endemic species. This fact leads us to believe that even though Isla Guadalupe is remote in distance, the influence of the California Current there is great.

The faunal affinity of opisthobranchs is mostly Temperate and Temperate-Panamic, half of them, 19 species being Temperate-Panamic, and 14 species (36.8%) exclusively Temperate. Only one species is possibly endemic, one more is circumtropical, two exclusively Panamic and one is also found in the tropical Atlantic Ocean.

Conclusions

The total number of known opisthobranchs of Guadalupe is rather small, considering the great size of the island. The variety of habitats as well as the observation of numerous prey items for opisthobranchs suggest that the number here presented should increase considerably with more intensive surveying.

The number of possible or known endemic species of opisthobranchs is also low if compared with the number of other considered endemic marine, land and freshwater mollusks.

This paper contributes significantly to the knowledge of the opisthobranch fauna of Isla Guadalupe, however further work is necessary to approach a more complete understanding of the taxonomic composition and faunal affinities of the mollusk group.

Acknowledgments

This work would not have been possible without the invaluable support and enthusiastic help of Roberto Chávez Arce, Pedro Medina Rosas and Mauricio Hoyos. Our thanks to the M/V *Nautilus Explorer* and Captain Mike Lever. A very special recognition to Avi Kepfler whose outstanding video images from deep waters allowed us to record some of the species.

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Table 1. Taxonomic Composition of the Opisthobranch Mollusks of Isla Guadalupe

Species	Geographic affinities
CEPHALASPIDEA	
ACTEONIIDAE	
Acteocina angustior Baker & Hanna, 1927	Panamic
Acteocina harpa (Dall, 1917)	Temperate
Acteocina magdalenensis Dall, 1919	Temperate
Acteocina inculta (Gould, 1855)	Temperate
Rictaxis punctocaelatus (Carpenter, 1864)	Temperate-Panamic
Cylichna attonisa (Carpenter, 1864)	Temperate
HAMINOEIDAE	
Haminoea angelensis Baker & Hanna, 1927	Temperate-Panamic
AGLAJIDAE	
Navanax aenigmaticus (Bergh, 1894)	Tropical Atlantic and Panamic
Navanax inermis (Cooper, 1863)	Temperate-Panamic
ANASPIDEA	
APLYSIIDAE	
Aplysia californica Pilsbry & Lowe, 1932	Temperate-Panamic
TYLODINIDAE	
Tylodina fungina (Gabb, 1865)	Temperate-Panamic
Umbraculum umbraculum (Lightfoot, 1786)	Circumtropical
PLEUROBRANCHIDAE	
Pleurobranchus aerolatus (Mörch, 1863)	Temperate-Panamic
Pleurobranchaea californica MacFarland, 1966	Temperate

Berthellina ilisima (Marcus & Marcus, 1967)	Temperate-Panamic
Berthella agassizii (MacFarland, 1909)	Temperate-Panamic
SACOGLOSSA	
PLACOBRANCHIDAE	
Elysia hedgpethi Marcus, 1961	Temperate-Panamic
NUDIBRANCHIA	
GONIODORIDIDAE	
Okenia rosacea (MacFarland, 1905)	Temperate
AEGIRETIDAE	
Aegires albopunctatus MacFarland, 1905	Temperate-Panamic
POLYCERIDAE	
Polycera atra MacFarland, 1905	Temperate-Panamic
Triopha maculata MacFarland, 1905	Temperate
DORIDIDAE	
Discodoris cf. *ketos* (Marcus & Marcus, 1967)	Panamic
Dorid sp. 1	Unknown (Figure 1)
Dorid sp. 2	Unknown (Figure 3)
Dorid sp. 3	Unknown (Figure 5)
CHROMODORIDAE	
Cadlina flavomaculata MacFarland, 1905	Temperate-Panamic
Cadlina modesta MacFarland, 1966	Temperate
Cadlina sparsa (Ohdner,1921)	Temperate-Panamic
Hypselodoris californiensis (Bergh, 1879)	Temperate-Panamic
Mexichromis porterae (Cockerell, 1901)	Temperate
DENDRODORIDIDAE	
Doriopsilla albopunctata (Cooper, 1863)	Temperate-Panamic
Dendrodoris behrensi Millen & Bertsch, 2005	Temperate (Figure 4)
DENDRONOTINA	
TRITONIIDAE	
Tritonia diomedea Bergh, 1894	Temperate
Tritonia sp.	Possibly endemic (Figure 6)
DOTOIDAE	
Doto amyra Marcus, 1961	Temperate-Panamic
ARMININA	
Armina californica (Cooper, 1863	Temperate
AEOLIDINA	
FLABELLINIDAE	
Flabellina trilineata (O'Donoghue, 1921)	Temperate
AEOLIDIIDAE	
Aeolidiella oliviae (MacFarland, 1966)	Temperate-Panamic (Figure 2)
FACELINIDAE	
Hermissenda crassicornis (Eschscholtz, 1831)	Temperate-Panamic
TERGIPEDIDAE	
Catriona ricketsi Behrens, 1984	Temperate
Cuthona lagunae (O'Donoghue, 1926)	Temperate

Plate 1. Figures 1-6. **(1)**: *Dorid* sp. 1 **(2)** *Aeolidiella oliviae* **(3)** *Dorid* sp. 2 **(4)** *Dendrodoris behrensi* **(5)** *Dorid* sp.3 **(6)** *Tritonia* sp.

BOOK NEWS: RUSSIAN OPISTHOBRANCHS

HANS BERTSCH

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Martynov, Alexander &Tanya Korshunova. 2011.
Opisthobranch Molluscs of the Seas of Russia. A Colour Guide to their Taxonomy and Biology.
Moscow: Fiton+. 232 pp. $80 (US)
ISBN 978-5-93457-358-5, available from Sea Challengers Natural History Books: www.seachallengers.com

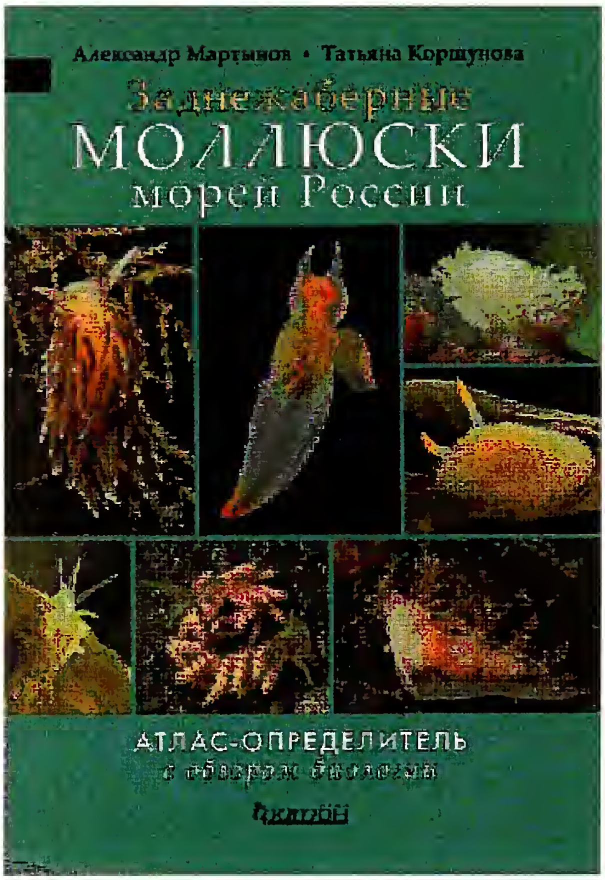

Figure 1. Cover of *Opisthobranch Molluscs of the Seas of Russia.*

Although I have read and written reviews for opisthobranch books published in German, Spanish and English, I could not read this book, written in Russian! However, a very careful page-by-age analysis of the diagrams, excellent color photos of living animals (*in situ*, portraits and close-ups) and scanning electron micrographs (SEMs) of the radulae and other anatomy, allow me to make a knowledgeable review. Senior author Alexander Martynov also graciously provided me with English translations of the main chapters and their sections, which are used herein.

The book's organization follows the traditional topics of other recent nudibranch field guides: an introductory section on what nudibranchs and their allies are all about, followed by the species' descriptions.

Part one titled "Biology of the Opisthobranch Molluscs," includes four divisions: "Systematic Placement of the Nudibranch and Opisthobranch Molluscs," followed by Morphology, Behavior, and Life Cycles of the opisthobranchs; each unit with numerous illustrations to demonstrate anatomical and biological characteristics. Line drawings indicate main external body features of the nine orders the authors consider, and two cut-away drawings show the generalized features of the digestive and reproductive systems.

The majority of this volume is the "Atlas (= Guide) of the Opisthobranch Molluscs of the Seas of Russia." The authors first describe the format of each species essay, and then discuss the concerns and history of animal naming.

The 103 species descriptions exceed field guide status. They are comprehensive essays about each species, usually including several photographs of the living animals (often with both dorsal and ventral views), their egg masses and behavior. The species names and authors are given in Roman type (most useful), and the species binomen is then presented in Cyrillic.

Species are arranged by family within nine orders:

Cephalaspidea (*s.s.*), Anaspidea, Thecosomata, Gymnosomata, Acochlidiida, Sacoglossa, Notaspidea (*sensu* Pleurobranchoidea), Doridacea and Nudibranchia. The inclusion of the pelagic thecosomes and gymnosomes, and the enigmatic interstitial and freshwater acochlidians is remarkable and unique for a "guide."

Taxonomy of the Opisthobranchia (*sensu latissimo*) is in great flux and has changed greatly in the past decade. Use of phylogenetic trees, and multi-morphometric and genetic analyses, has refined our understanding of the evolutionary relationships within this group (see, *e.g.*, Wägele & Willan, 2000; Wägele, Vonnemann & Wägele, 2003; and Bouchet & Rocroi, 2005). The traditional Notaspidea is polyphyletic and has been separated into Tylodinoidea, the external shelled species such as *Anidolyta spongotheras* (Bertsch, 1980), and Pleurobranchoidea, internally or shell-less, such as *Bathyberthella antarctica* Willan & Bertsch, 1987. The taxon Nudipleura includes Pleurobranchoidea and Nudibranchia. Although there are two lineages within the nudibranchs, the Holohepatica (Anthobranchia, or the dorids) and the Cladohepatica (Cladobranchia, including the polyphyletic arminids, the dendronotids, and the aeolids), it would better indicate the phylogenetic relationships within Nudipleura not to elevate the dorids to the same ordinal rank as the higher monophyletic Nudibranchia (within which it is often included; see trees in Wägele & Klussmann-Kolb, 2005; and Wägele et al.,2008: 396).

There are two important theoretical evolutionary figures in this book; both are published elsewhere with figure captions and discussions in English. The phylogenetic tree showing relationships among the Plerurobranchoidea originally accompanied the Martynov & Schrödl (2008) naming of the genus *Boreoberthella*. The significant drawing on p. 99 presents a new model of dorid evolution, *ontogenetic systematics*, which challenges current phylogenetics and systematics to consider not only evolutionary "lines" and "branches," but also ontogenetic cycles (Martynov, 2011).

While page-turning the species essays, it was a pleasant surprise to find "old friends" that I've personally studied either along the coast of California or at Bahía de los Ángeles in the Sea of Cortez. These include *Diaulula sandiegensis* (Cooper, 1863), *Triopha catalinae* (Cooper, 1863), *Hermissenda crassicornis* (Eschscholtz, 1832), *Aeolidia papillosa* (Linnaeus, 1761), and *Aplysia parvula* Guilding in Mörch, 1863. This emphasizes the wide spectrum of faunal temperature regimes in Russian seas—boreal Arctic, temperate and tropical. These records could be quite useful for comparative provincial-level zoogeographic studies (such as Bertsch, 2010). But all their data are presented in Russian.

Language barrier aside, I must, however, criticize the authors for not including a map of Russia, with collecting sites indicated and number-keyed to each species. The final pages of the book include an Afterword, Glossary of Terms (in Russian), a taxonomic index (in Roman type), and a short list of Russian and English references.

In summary, Alex Martynov and Tanya Korshunova have written an outstanding, scholarly work, though of limited accessibility. It behooves university and museum libraries, hard-core nudibranchophiles and purveyors of fine photography (especially with correctly identified species) to own this book. It definitely merits attention.

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PROGRAM

Come to the Auction/Potluck
Saturday evening, April 28th

There is no regular meeting this month.

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CONTENTS

Club news 44
Montage from the March meeting 45
Gibberulus gibbosus (Röding, 1798) (Caenogastropoda: Strombidae) from the Islas Galápagos?
GIJS KRONENBERG 46
A few observations of the Seashells of Rapa Nui (Easter Island)
ALEXANDER P. SASSI 48

CLUB NEWS

San Diego Shell Club Minutes
March 15, 2012

The brief business meeting was called to order at 7:40 PM by President Bob Dees in which previous minutes were approved and the Treasurer's report was accepted. However --THIS MEETING WAS A CELEBRATION!

Carole and Jules Hertz received the first annual award from the SDSC for Lifetime Contributions to Conchology or Malacology and Eugene Coan and Paul Valentich-Scott presented their new book on the *Bivalve Seashells of Tropical West America*.

The turnout for the meeting was wonderful – most local members attended and there were also interested guests. A buffet had been set up with wraps, shrimp, desserts, sparkling cider and coffee. Attendees congregated near the food table and at the display of the two volumes of this exciting new book. Order forms were available, as only a representative few copies were yet available.

As the program began, Carole and Jules were called up by Bob Dees who introduced them with some very special words and presented them with the first SDSC annual award honoring them for their years of contributions and achievements in malacology -- the beautifully-designed, personalized glass-like award was etched with the words outlining the purpose of the award.

After the award presentation, Vice President David Waller introduced the special guests of the evening, the two authors of the magnificent new book – two volumes on the bivalve species from the Panamic Province.

Gene Coan began their slide presentation with an abbreviated history, with photos, of the contributors to the field of malacology from Linnaeus, Lamarck and others of that period to present workers. This was followed by Paul Valentich-Scott who took the audience to beaches, private collections and museums around the world as he and Gene worked to locate type material, study habitats and collect specimens for the book. It was a delightful trip through history as well as the story behind the preparation for this beautiful new work.

Socializing, snacking and visiting with the authors and congratulating the recipients of the plaque continued following the program until it was time to leave.

Come to the Auction/Potluck
Saturday, April 28th

The Shell Club's annual auction/potluck will be held, once again, at Wes Farmer's community room at 3591 Ruffin Road, San Diego 92123. For directions call 858-277-6259 or e-mail jhertz@san.rr.com

Festivities begin at 5 PM for "Dave's Punch" and other beverages, time for visiting with friends and viewing the voice-auction table and the silent auction setup. The $1-table (a whole ping-pong table of treasures) will be open during the break later in the evening. Dinner will be at 6 PM with all the potluck delicacies provided by the attendees who are asked to bring a dish serving 12 – either a salad, main dish or dessert – with serving utensils, please. Call the Hertzes (858-277-6259) for further information.

The auctioneer will call the voice auction, the main excitement of the evening, promptly at 7 PM. The auction is our Club's biggest fun and fundraising event of the year. It supports Club activities such as *The Festivus*, social events and donations to scientific efforts and events. If you are unable to attend the auction, and would like to bid on any item[s], a Club member disinterested in your choice will bid for you following your instructions. Looking forward to seeing you all at the Auction/Potluck 2012!!

Plate caption: **Top row**, l-r. Wes Farmer, Evelyn & Don Smith, Jules & Carole Hertz. **Second row**, l-r. Smiths & Bob Dees, Larry Buck, Martin Schuler & Stephen Mulliner. **Center row**. All attendees with Eugene Coan and Paul Valentich-Scott. **Fourth row**, l-r. Bob Dees, George Kennedy, Jules & Carole Hertz, Eugene Coan, Bob Dees, Paul Valentich-Scott. **Bottom row**, l-r. Lance Gilbertson, Paul Valentich-Scott, David Waller & Rick Negus. ➜

Selected Photos of the Attendees at the March 2012 Meeting of the San Diego Shell Club

GIBBERULUS GIBBOSUS (RÖDING, 1798) (CAENOGASTROPODA: STROMBIDAE) FROM THE ISLAS GALÁPAGOS?

GIJS KRONENBERG

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Abstract The single record of the strombid gastropod *Gibberulus gibbosus* (Röding, 1798) from Islas Galápagos, should be deleted from faunal lists of those islands.

Introduction

Mienis (1978) reported on one specimen of *Strombus (Gibberulus) gibberulus* (Röding, 1798), now considered as *Gibberulus gibbosus* from Bahía Conway, Isla Santa Cruz, Islas Galápagos. This record was subsequently referred to by e.g. Skoglund (2002) and Kronenberg & Lee (2007). Finet (1994) had already noted that this record needed confirmation.

Re-identification

A re-examination of the specimen reported by Mienis (1978) in September 2011, revealed that this is a specimen of *Gibberulus gibberulus* (Linnaeus, 1758) (Naturalis Biodiversity Center, coll. nr. RMNH.MOL. 179265, fig. 1). It should be noted that both species are not always easily identified with certainty, but with Abbott (1960) and Coomans & Van Amsterdam (1970) identification should be no problem.

When making further enquiries with the curator of Mollusca in Naturalis Biodiversity Center, Mr. Jeroen Goud, it became apparent that the collector of the specimen under discussion, Mr. J.H.C. Walenkamp, had also collected shells in Kenya, East Africa, at about the same period as he spent time at the Islas Galápagos. Although Mr. Goud had asked him whether a mix-up of samples or locality slips might have occurred, the collector denied this.

Gibberulus gibberulus has its distribution in the Indian Ocean, including the coast of Kenya, while *G. gibbosus* lives in the Pacific (Abbott, 1960) with a

Figure 1. *Gibberulus gibberulus* (Linnaeus, 1758). Two views of specimen allegedly from Bahía Conway, Isla Santa Cruz, Islas Galápagos. RMNH.MOL. 179265. Actual height 35.9 mm. Photograph by Jeroen Goud.

possible small overlap of both ranges in the Indonesian Archipelago (Coomans & Van Amsterdam, 1970). Therefore, despite the denial by Mr. Walenkamp to Mr. Goud's question, it is suggested here that, indeed, an inadvertent mix-up of samples of data slips had occurred.

Conclusions

Based on both the identification of the specimen and the questionable locality data accompanying the specimen discussed herein, and the known distribution of both *G. gibberulus* and *G. gibbosus*, it is concluded that 1) the latter species should be deleted from faunal lists on the marine life of the Islas Galápagos until a reliable record turns up (see also Finet, 1994) and 2) even if the specimen under discussion was found at the Islas Galápagos, there is no reason whatsoever to include *G. gibberulus* in faunal lists of the Islas Galápagos taking into consideration the distributional range of *G. gibberulus*, as it is extremely unlikely that a larval specimen would be able to cross the Pacific from eastern Java and reach maturity at the Islas Galápagos.

Acknowledgments

I want to thank Mr. Jeroen Goud, Naturalis Biodiversity Center, Leiden, The Netherlands for providing additional information on the specimen discussed and photographed, and my partner Ms Marianne Matthijssen, Eindhoven, The Netherlands for her abiding support.

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A FEW OBSERVATIONS OF THE SEASHELLS OF RAPA NUI (EASTER ISLAND)

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The shoreline of Rapa Nui, also known as Easter Island, appeared all of a sudden as the LAN Chile jet descended through the clouds. After approximately six hours of flying from Chile's capital, Santiago, I was now seeing the backs of the enigmatic statues (moai) and the ocean crashing against the dark volcanic coastline. Soon the plane was on the ground and shortly thereafter – the airport being small – I was at Hotel Gomero, which would be my base for the five days that followed.

Rapa Nui is not a big place, consisting of approximately 45 square miles, and it is far away from almost everywhere (Beech et al., 2006). It marks one of the three corners of the Polynesian triangle, with Hawai'i and Aotearoa (New Zealand) being the other two corners. Hanga Roa is the only town, with approximately 4,000 residents, in this triangular island formed of lava flows from three volcanoes (Figure 1). Most of the island is grassy; the native conifers and palms having been cut down long ago. I have come to this far off place to see the moai and ceremonial platforms (ahu) myself, which is what I do every day of my short stay. Of course there are seashells to be found, though the tides were not particularly low. The following is an account of the shells I observed during my visit.

Figure 1. View past Ahu Ko Te Riku, Ahu Tahai, and Ahu Vai Ure towards Hanga Roa, Rapa Nui. In the background is Rano Kau, approximately 324 m in height, where the Orongo ceremonial village is located.

Rehder (1980) reported 133 species of mollusks for Rapa Nui, which compared to other small Pacific islands is relatively poor in molluscan life; however, several handsome gastropods make their home on this island. The easiest to locate by far was the endemic *Cypraea caputdraconis* Melville, 1888, which is similar in appearance to *Cypraea caputserpentis* Linnaeus, 1758, of the Indo-Pacific. Finding *C. caputdraconis* on Rapa Nui does not even entail going to the beach or getting wet; one simply looks at the necklaces sold and given to tourists (Figure 2) and on the costumes of the dancers who perform in the evenings.

Figure 2. Close-up of a pendant incorporating the native cowry, *Cypraea caputdraconis*.

The coastline was a short walk from my hotel. Among the lava rocks were numerous *Nerita morio* (Sowerby, 1833) and *Nodilittorina pyramidalis pascua* Rosewater, 1970. Caleta Hanga Roa, across from the soccer field, has a small sandy beach where I found several other small species in the beach drift: the bivalves *Codakia bella* (Conrad, 1837) and *Semele australis* (Sowerby, 1833), and the gastropods *Mitra flavocingulata* Lamy, 1938 and *Pilosabia trigona* (Gmelin, 1791).

On one of the days, I went on a guided tour of the major archaeological attractions with several German tourists that were staying at the hotel. One of the most impressive sites I visited was Ahu Tongariki (Figure 3), whose moai were carried inland by the tsunami of 1960 and restored to their positions by the Japanese between 1992 and 1995. While I was walking on the back side of the ahu (the moai face inland), I looked down and found *Planaxis akuana* Rehder, 1980, perhaps a subfossil, as its aperture was filled solid with the reddish dirt ubiquitous on the island. On an-

Figure 3. Some of the moai restored to their positions on the platform at Ahu Tongariki.

other day, I hired a taxi to drop me off at Ahu Te Pito Kura, which, at 10 meters, is the tallest moai known to have been erected on an ahu. Ahu Te Pito is situated at La Perouse Bay, and adjacent to the ahu is a smooth, round, magnetic boulder believed to have been brought to the island by Hotu Matua, the first king, sometime between 450 and 800 years AD. In the cove behind the ahu were numerous rounded stones and tidepools where I found *N. morio*. In this environment of calmer waves, the nerites were noticeably several millimeters larger.

From La Perouse Bay I set off on a footpath through grass-covered, small hills towards Ovahe, one of the few sandy beaches. Along the way, I saw many residents gathering sea urchins and barbecuing next to their vehicles along the coast. As I got to the beach at Ovahe, the rocks again became smooth and rounded. Here among the rocks I found both species of nerite: *N. morio* and *Nerita lirellata* Rehder, 1980, with small populations of *N. lirellata* tending to be on the smoothest rocks. The two nerite species look almost the same from a distance but can be distinguished upon closer examination by differences in the sculpture of the shell and the operculum. At the far end of the pinkish sand of the beach, I climbed up the cliff and, from the top, spied beautiful and large tidepools which reminded me of the Great Tide Pool in Pacific Grove, California, where Ed Ricketts collected for his laboratory. I followed a small path down the other side of the cliff to the edge of one of the pools and found *Conus miliaris pascuensis* Rehder, 1980, *Strombus maculatus* Sowerby, 1842 (Figure 4), *Neothais nesiotis* (Dall, 1908) and *Morula praecipua* Rehder, 1980 among the rocks at the water's edge (Table 1).

Every evening while I was there, tourists walked along one of the paths leading out of Hanga Roa along the shoreline to grab a spot on a hill and watch the sun set behind the moai at Ahu Ko Te Riku. One evening I set off a bit early to see what could be found in the intertidal zone along the way. As in Hanga Roa, small *N. morio* and *N. pyramidalis pascua* inhabited the holes and crevices of the lava rock. At Ahu Tahai, I found the only chiton I saw during my visit, *Plaxifora mercatoris* Leloup, 1936, nestled in a small pocket among the rocks.

The last place I investigated for shells was the Mercado Artesenal (crafts market) at the corner of Avenida Tu'u Koihu and Ara Roa Rakei. Immediately to the left upon entering was a stall with a small basket full of *C. caputdraconis*. This booth was the Only one that had loose cowries – i.e. ones that were

not incorporated into handicraft such as necklaces, bracelets, earrings, etc. As I hadn't found any cowries on my own, I sorted through the ones in the basket to pick out three different color forms. As I was doing this, the proprietor of the stall approached me and asked if I was a shell collector - and indeed I am. He said he had some shells to show me and then produced a small Ziploc bag with several *Cypraea englerti* Summers & Burgess, 1965 (Figure 5), that had been collected by diving in La Perouse Bay. This cowry is named after Father Sebastian Englert, a Franciscan missionary priest who worked on Rapa Nui from 1935 until his death in 1969. Father Englert spoke the Rapa Nui language and was known for his extensive personal research and knowledge of the ethnology and anthropology of the Rapa Nui people. I chose one of the *C. englerti* and took his card.

Even though Rapa Nui is a small and distant island, I was sure I would return.

Figure 4. *Strombus maculatus*, 23 mm, just above the water line at a tide-pool near Ovahe Beach.

Figure 5. Father Englert's cowry, *Cypraea englerti*, 25 mm, purchased in the crafts market.

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Table 1. Species observed on Rapa Nui

Fifteen species were observed. Coloma et al. (2004) reported observation of 33 species in the littoral zone. Abbreviations used: L=live in the intertidal zone; D=beach collected; P=purchased.

Bivalvia	Gastropoda	Polyplacophora
Codakia (Epicodakia) bella (Conrad, 1837) (D)	*Conus miliaris pascuensis* Rehder, 1980 (L)	*Plaxifora (Mercatora) mercatoris* Leloup, 1936 (L)
Semele australis (Sowerby, 1833) (D)	*Cypraea caputdraconis* Melvill, 1888 (P)	
	Cypraea englerti Summers & Burgess, 1965 (P)	
	Morula praecipua Rehder, 1980 (L)	
	Mitra flavocingulata Lamy, 1938 (D)	
	Neothais nesiotis (Dall, 1908) (L)	
	Nerita (Heminerita) lirellata Rehder, 1980 (L)	
	Nerita (Heminerita) morio (Sowerby, 1833) (L)	
	Nodilittorina pyramidalis pascua Rosewater, 1970 (L)	
	Pilosabia trigona (Gmelin, 1791) (D)	
	Planaxis (Hinea) akuana Rehder, 1980 (D)	
	Strombus maculatus Sowerby, 1842 (L)	

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PROGRAM

Ocean Acidification: an Emerging Frontier

Dr. Andrew Dickson, professor of marine chemistry in the Marine Physical Laboratory at the Scripps Institution of Oceanography, will discuss his research on the effects on marine organisms caused by ocean acidification – carbon dioxide dissolved in seawater from the atmosphere. The oceans have already absorbed 30% of the carbon dioxide that humans have ever produced and absorbing more each year changes the ocean chemistry and makes it harder for many organisms to form their shells.

CONTENTS

Club news.. 54
Range extension for *Erosaria poraria* (Mollusca: Cypraeidae)
DAVID B. WALLER..55
In Memoriam: John Arthur Bishop, MD..62

CLUB NEWS

The Auction/Potluck - 2012

And what a party it was! The more than thirty members and guests had a great time. At the start, the "Dave's punch", wine and soft drinks were ready, the food table was loaded with delectable dishes and the auction tables, voice and silent, were filled with temptations. What could be better?

After socializing, touring the auction tables (signing on to great deals at the silent auction array) and stuffing ourselves on the delicious food, auctioneer Carole Hertz called the voice auction to order promptly at 7 PM for an evening of serious and fun bidding.

There were exciting items up for bid - books, original art and terrific shells. *Cypraea rashleighana* was **the** most wanted of the cowries while other favorite cowries were *oceanica* and *kwajaleinensis*. And there were muricids - *burnetti, centrifuga* and *miyokoae* as well as *Conus hirasei, Fusinus irregularis*, a large group of ovulids, giant volutes and murex and so much more.

At break time, for dessert and a rush to the Dollar table, members also went to the voice auction table to put the shells in which they were still interested on one side for continued bidding with the rest put away for another year. Amazingly, this year there were still many people still wishing to bid on for the second half of the evening. What a fun time it was!

So many helped to make the auction a success. Those who donated auction material are Marty Beals, David Berschauer, Twila Bratcher & Billee Dilworth Estates, Henry Chaney, Sally Fall, George Gerrodette, Carole & Jules Hertz, Paul Kanner, Richard McClincy, Stephen Mulliner, Rick Negus, Lois Nelson, Suzanne Parlett, Tony Phillips, Don & Jeanne Pisor, Charles Powell and Marty Schuler. And those who worked very hard to prepare for the auction - Dave Waller confirmed and identified cowries and arranged for donations, the Club board prepared specimens for the auction and, additionally, Paul Tuskes prepared items for the silent and dollar auction tables. Jim Goldammer set up the lights, John LaGrange took care of making "Dave's Punch", Griffin Catarius was our faithful and excellent distributer of shells, and our host and photographer was Wes Farmer.

What would we do without Wes who has now hosted this wonderful event for 25 continuous years!!

Additions to the Club Roster

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The September Party - 2012

The date has been set for the annual September party. It will be held on the afternoon of Saturday, September 22nd. Once again it will be held at the home and garden of Debbie and Larry Catarius - the home of many recent and enjoyable September parties.

More information will be available as the time gets closer. But - save the date for this enjoyable party.

The Greater San Diego Science and Engineering Fair - 2012

Again this year the Club participated in the annual Science Fair as the Club has done for many years. However, this year the Club's judges, Paul Tuskes and Carole Hertz, were unable to find a worthy project on marine life in either the senior or junior division.

The judges were disappointed that they would not be able to give an award this year.

RANGE EXTENSION FOR *EROSARIA PORARIA* (MOLLUSCA: CYPRAEIDAE)

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ABSTRACT: Two specimens collected by H.N. Lowe in the Gulf of California (H.N. Lowe Collection, San Diego Natural History Museum [SDNHM 61593]) were identified as *Erosaria albuginosa* (Gray, 1825) with a note by C.C. Finley that their base was colored like *Erosaria poraria* (Linnaeus, 1758). Only one of the two specimens remains in the SDNHM collection and was the focus of this investigation. The specimen, which appears to have been collected dead, is described on the basis of its conchological characteristics and compared to *E. albuginosa* and *E. poraria* from the Philippines and Hawaiian Islands. *Erosaria poraria* is distinguished from *E. albuginosa* by having elongated teeth on both the labral and columellar sides of the base, a visible double row of teeth in the fossula, an often distinct deep pitting on either side of the anterior marginal calluses and a narrower anterior aperture. *Erosaria poraria* from the Gulf of California and Hawaiian Islands is distinguished from *E. poraria* of the Philippines by its pyriform shape. The specimen collected by H.N. Lowe is *E. poraria* and has all of the distinguishing characteristics of the species. Other *E. poraria* specimens from the Panamic region, one within the SDNHM collection also from the Gulf of California collected by H.N. Lowe (SDNHM 42293), one specimen collected from the Galapagos Islands (R. Negus) and two specimens collected by K.L. Kaiser on Clipperton Island support the range extension of this species.

INTRODUCTION

Herbert Nelson Lowe (1880-1936), a long time resident of Long Beach, California, was a prominent shell collector specializing in mollusks of the Panamic Province. He authored 26 papers most of which were published in *The Nautilus* and is known for his work with Henry Pilsbry titled *West Mexican and Central American Mollusks Collected by H.N. Lowe, 1923-1932* published in 1932. In his career, he described over 160 new molluscan species both terrestrial and marine. He made notable donations of shells and crustaceans from Catalina and San Clemente Islands to the Smithsonian Institution in 1904 and 1919 and donated 42 lots of Cuban shells to the Museum of Zoology at the University of Michigan in 1920. Upon his death he bequeathed his shell collection to the San Diego Society of Natural History together with a $25,000 endowment for its maintenance (Hertz, 1986). The *E. poraria* specimen discussed in this article is part of the H.N. Lowe collection donated to the SDNHM in 1936. The shell appears to have been collected dead and no remains of the animal were available for anatomical or molecular studies.

DISCUSSION

Erosaria poraria are widely distributed throughout most of the Indo-Pacific, from along East Africa (Somalia, Kenya and Tanzania), throughout the Indian Ocean and tropical western Pacific to the Hawaiian Islands. While the distribution of this species is substantial, no reports of it in the Panamic region have been found (Emerson & Chaney, 1995). This region includes the ocean and shore lines below 25 degrees north encompassing Bahia Magdalena, Baja California, Mexico, and above 6 degrees south in Peru (Keen, 1971 and Skoglund, 2002). This species lives in shallow intertidal water at depths ranging from 1-30 meters on tropical reefs, dead corals, under large rocks or in caves. Synonyms for this species include: *Cypraea coeca* Röding,1798; *C. kauaiensis* Melvill, 1888; *C. kawaiensis* Melvill, 1888; *C. albinella* Melvill & Standen,1895; *C. wilhelmina* Kenyon, 1897; *C. vibex* Kenyon, 1902; *C. insignis* Dautzenberg, 1903; *E. poraria theoreta* Iredale, 1939; and *Erronea mbalavensis* Ladd, 1945.

Erosaria albuginosa is commonly distributed throughout the Tropical Eastern Pacific, along the coast

of Mexico, south to Peru including the oceanic islands. It lives in shallow intertidal water at depths of 1-40 meters.

Comparison : *Erosaria poraria* differs morphologically from *E. albuginosa* in shape, basal coloration, teeth structure, anterior aperture width, extremity configuration and marginal topography (Tables 1 and 2). The shape of *E. poraria* from the Indo-Pacific region is oval (Figure 8), which is easily distinguished from the elongated pyriform shape of *E. albuginosa* (Figure 2). In one lot of *E. poraria* from Hawaii (Figure 7) donated to the SDNHM by Mary G. Beckwith (SDNHM 20925), some specimens were found having a pyriform shape with others having the more common oval shape.

The basal coloration of *E. poraria* ranges from deep purple to light pink and fading can be observed in older specimens. This coloration extends from the marginal callus onto the base, fading to white near the teeth. In *E. albuginosa* the purple along the marginal callus extends to the perimeter of the base, fading to white at about half the distance to the aperture. There is often darker purple spotting observable in the pigmented area on the columellar side of the base. While this basal coloration is consistent in *E. albuginosa*, similar base coloration and spotting has been observed in a few *E. poraria* specimens.

The teeth of *E. poraria* are elongated often extending half way to the marginal callus on both the columellar and labral sides with a shortening of teeth length about mid-range on the labral side. *Erosaria albuginosa* does not have significant elongated teeth. However, the author has observed a few specimens with minor elongation of teeth on the labral side and less frequently on the columellar side. What seems to be the most significant morphological difference between these two species is the distinct double row of teeth in the fossula of *E. poraria*, absent in *E. albuginosa* (Figure 4). While some *E. albuginosa* appear to have a second row of teeth in the fossula these are greatly reduced features (a few bumps) that may be an extension of the anterior fossula teeth - the elongation of the primary tooth.

The aperture width of *E. poraria* is often narrower than the aperture width of *E. albuginosa*, particularly at the anterior end. While the aperture of *E. poraria* varies slightly along its length, the aperture of *E. albuginosa* begins to broaden at about two-thirds the distance along the length of the aperture from posterior to anterior end (Figure 5). In some specimens of *E. albuginosa* the broadening can be less significant than in others. However, the aperture width is frequently larger in this species when compared to *E. poraria*.

The extremity configuration of *E. albuginosa* is more elongated than that of *E. poraria*, which is more blunt-ended. The dorsal curvature of *E. poraria* is continuous from the dorsal peak to the extremities. In *E. albuginosa*, the extremities extend beyond the dorsal curvature (Figure 11).

Another significant morphological difference is the marginal pitting present in *E. poraria*. This pitting appears in mature specimens primarily on the anterior marginal callus, but can also appear on the posterior margin. In *E. albuginosa*, there is a similar depressed topography on the anterior end, described here as dimpling, but does not have the definition of the pitting on *E. poraria* (Figure 6). However, some specimens of *E. poraria* have been observed that do not have either pitting or dimpling, which is speculated to be the result of age.

Dorsal coloration and patterns are similar between the species and vary so substantially that this does not seem to be a distinguishing factor to allow for easy separation of the two species. The similar dorsal patterning and coloration between *E. albuginosa* and *E. poraria* may explain the misidentification of *E. poraria* specimens found in the Panamic region.

The H.N. Lowe specimen (Figure 1) from the Gulf of California (SDNHM 61593), differs from specimens collected in the Indo-Pacific by having a pyriform rather than an oval shape. It does not display the usual intense basal coloration of typical *E. poraria* specimens. It is speculated that this light basal coloration may be due to the age of the shell that may have been collected more than 70 years ago. The teeth are elongated, the aperture is narrow with a distinct double row of teeth in the fossula consistent with *E. poraria*. The extremities are blunt-ended and marginal pitting can be observed on the labral side of the anterior end. The pitting is not as clear as other specimens and may be due to wearing in the surf.

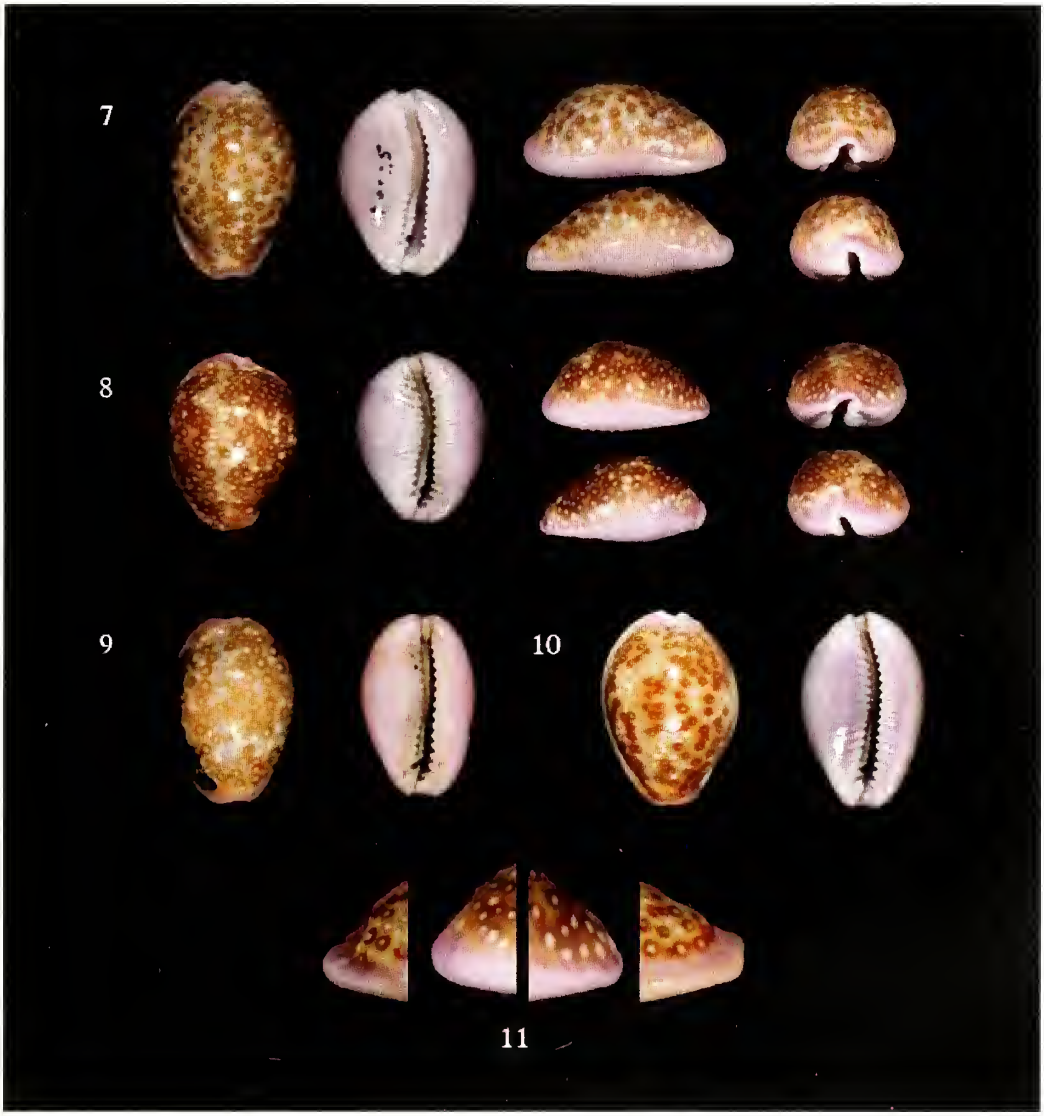
Further investigation of the SDNHM Collection identified one other *E. poraria* in a lot of five specimens labeled *E. albuginosa* from the Gulf of California collected by H.N. Lowe (SDNHM 42293, Figure 9). While this specimen was much smaller than the first, being only 13.5 mm in length, its other morphological characteristics including elongated teeth, the double row of teeth in the fossula and purple base are consistent with *E. poraria*. In addition, three other *E. poraria*

were identified, one from the collection of R. Negus labeled as *E. albuginosa nariaformis* from the Galapagos Islands and two from the collection K.L. Kaiser labeled *E. albuginosa* from Clipperton Island. All of these specimens have similar morphological characteristics as those reported for the *E. poraria* in this paper.

Location/ characteristic	**Philippines**	**Hawaii**	**Gulf of California**	**Galapagos**	**Clipperton**
Number of specimens	17	17	1	1	2
Shell shape	Oval	Pyriform	Pyriform	Pyriform	Pyriform
Shell length Average Range	17.7 mm 16.5-19.8 mm	16.6 mm 14.2-19.3 mm	20.8 mm	22.4 mm	18.7 mm 16.6-20.7 mm
Shell W/L Average Range	0.70 0.67-0.75	0.65 0.61-0.70	0.70	0.71	0.65 no range
Shell H/W Average Range	0.76 0.73-0.79	0.77 0.75-0.79	0.79	0.75	0.78 0.76-0.79
Columellar teeth	15 elongated	15 elongated	17 elongated	17 elongated	17 elongated
Labral teeth	14 elongated, shortening midrange	14 elongated, shortening midrange	14 elongated, shortening midrange	14 elongated, shortening midrange	15 elongated, shortening midrange
Fossula teeth	Double row of teeth	Double row of teeth	Double row of teeth	Double row of teeth	Double row of teeth
Basal color	Light to dark purple except near teeth	Light to dark purple except near teeth	Purple except near teeth	Light pink except near teeth	Light violet except near teeth
Marginal pitting	Both sides of anterior end and labral side of posterior end	Both sides of anterior end and labral side of posterior end	Both sides of anterior end and labral side of posterior end	Both sides of anterior end and posterior end	No pitting

Table 1: Morphological data of *E. poraria* from the Philippines, Hawaii, the Gulf of California, the Galapagos and Clipperton Islands. The Philippine specimens are from the Daniel Spelling Collection, the Hawaiian specimens are from the Mary G. Beckwith Collection at the SDNHM (SDNHM 200925), the Galapagos Island specimen is from the Rick Negus Collection and the Clipperton Island specimens are from the Kirstie L. Kaiser Collection.

Figures 1-6. **(1)** *Erosaria poraria* collected by H.N. Lowe (SDNHM 61593) **(2)** *E. albuginosa* from Mexico **(3)** *E. poraria* from the Galapagos Islands **(4)** *E. albuginosa* from the Galapagos Islands **(5)** Fossula and aperture detail of *E. albuginosa,* right and *E. poraria,* left **(6)** Pitting detail of *E. poraria*, top and *E. albuginosa*, bottom.



Figures 7-11. **(7)** *Erosaria poraria* from Hawaii **(8)** *E. poraria* from the Philippines **(9)** *E. poraria* from the Gulf of California collected by H.N. Lowe (SDNHM 42393) **(10)** *E. poraria* from Clipperton Island and **(11)** Terminal end detail, *E. poraria* bracketed by *E. albuginosa*.

Location/ characteristic	Mexico	Galapagos
Number of specimens	17	1
Shell shape	Pyriform elongate	Pyriform elongate
Shell length Average Range	 24.5 mm 21.7-28.3 mm	26.6.mm
Shell W/L Average Range	 0.61 0.58-0.67	0.61
Shell H/W Average Range	 0.77 0.74-0.81	0.76
Columellar teeth	18	17
Labral teeth	16	16
Fossula teeth	Single row of teeth	Single row of teeth
Basal color	Light violet-purple with darker purple spotting	Violet with darker purple spotting
Anterior pitting	No pitting	No pitting

Table 2: Morphological data of *E. albuginosa* from Mexico and the Galapagos Islands. The Mexico specimens are from the Norman Currin Collection donated to the San Diego Shell Club and the Galapagos Islands specimen is from the author's collection.

CONCLUSION

The initial finding of *E. poraria* by H.N. Lowe in the Gulf of California was likely labeled *Cypraea albuginosa* because of their similar dorsal appearance and the fact that *Erosaria poraria* was not known to occur in the region. However, there was some question as to its identity based on a handwritten note by C.C. Finley stating that the two specimens had the dark purple basal characteristics similar to *E. poraria*. The finding of another *E. poraria* specimen in a group of five, labeled *E. albuginosa* from the Gulf of California in the SDNHM Collection, provides additional support that this species is present in the region. Further investigation, identified three more specimens of *E. poraria*, one specimen collected off the coast of the Galapagos Islands and two specimens collected off the coast of Clipperton Island. These additional findings have broadened the range of *E. poraria* into the Panamic region and would predict the presence of *E.albuginosa* in the Indo-Pacific. These specimens and their location data provide support for extending the range of *E. poraria* into the Panamic region.

ACKNOWLEDGMENTS

Special thanks to the reviewers for their comments and to the Department of Marine Invertebrates, San Diego Natural History Museum for allowing access to their collection for this investigation. Thanks to James Berrian, Field Entomologist at the SDNHM, for his photographic expertise and to Carole Hertz for her help. Thank you to Kirstie L. Kaiser, Rick Negus and the San Diego Shell Club for providing specimens that helped support the range extension of this species.

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In Memoriam

JOHN ARTHUR BISHOP, MD
June 21, 1918 - April 4, 2012

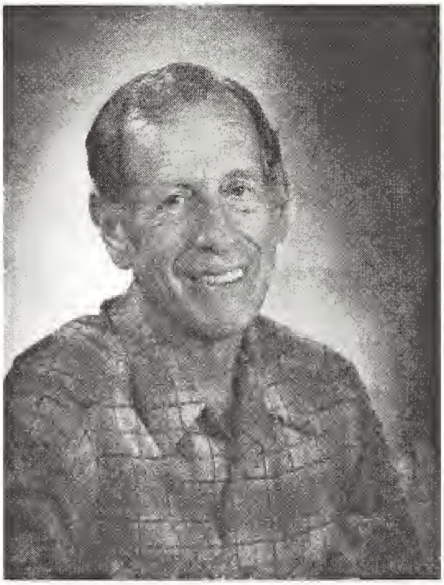
It is with sadness that we report the passing of our friend John Bishop, a longtime member of the San Diego Shell Club. John was a pediatrician in San Diego for 35 years with a long list of volunteer humanitarian service. He was awarded *Volunteer of the Year 2000* by the San Diego County Board of Supervisors and *Physician of the Year* by the San Diego County Medical Society in 1992 and *One of San Diego's Twelve Finest Citizens* by the City Club of San Diego in 1993 among others, and served on many advisory boards and campaigns in the medical field.

He was also a great traveler/explorer beginning in his youth when he traveled around the world with his grandfather, and continuing to recent years. He loved the ocean, enjoyed studying his family ancestry in Hawaii and soon discovered The San Diego Shell Club in 1987.

He was active and curious about all aspects of malacology. The members enjoyed the stories of his trips, helping identify some of the specimens he'd found and learning from some of the astute questions he asked.

Some of his collecting efforts resulted in papers in the Club's peer-reviewed publication, *The Festivus* (see below) and a contribution to the 2000 book *Amphibians and Reptiles of Baja California* by Ron H. McPeak, published by Sea Challengers.

Our condolences to John's surviving family: his four children, ten grandchildren and four great grandchildren.



John Bishop

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THE FESTIVUS

A publication of the San Diego Shell Club

Volume: XLIV June 14, 2012 Number: 6

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Single copies of this issue: \$5.00 plus postage.

Meeting date: third Thursday, 7:30 PM,
Room 104, Casa Del Prado, Balboa Park, San Diego.

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PROGRAM

ARUBA

Shawn Wiedrick, current president of the Pacific Conchological Club and volunteer in the Malacology Department of the LACM, will be the evening's speaker. He will present an illustrated program on his research on the micro-molluscan fauna of Aruba, Netherlands Antilles, with mollusks taken by SCUBA from grunge samples in the southern part of the island during 2010 and 2011.

Meeting date: June 21st at 7:30 PM

CONTENTS

Club news 64
Clathrodrillia phasma (Schwengel, 1940) (Gastropoda: Drilliidae), an east Florida species reported herein from three quadrants of the Gulf of Mexico
EMILIO F. GARCÍA 65
Further surveys of the marine mollusk fauna of the island of St. Kitts, Leeward Islands, West Indies, Part I
SUSAN J. HEWITT 68
A pictorial view of the fun at the recent San Diego Shell Club Auction/potluck 73

CLUB NEWS

San Diego Shell Club Meeting
17 May 2012

The meeting was called to order at 7:30 PM by President Bob Dees. The previous minutes were approved as printed. The Treasurer and Corresponding Secretary were absent. With few announcements, David Waller, Vice President, introduced the speaker.

Dr. Dickson, from Scripps Institution of Oceanography, specializes in marine chemistry and works in collaboration with biologists. His topic was *Ocean Acidification: an Emerging Frontier* and the talk focused on carbon dioxide and the impact it has on pH and sensitive biological systems. There is a great deal of concern regarding the current and future effect of ocean acidification. The work of the late Dr. Keeling on Mauna Loa in Hawaii has shown a steady increase in CO_2-level from 315 ppm in 1956 to the current 395 ppm in 2010. At times, levels have been much higher in the geological past, but they correlate well with major decrease in biological diversity. A notable event about 60 million years ago required the ocean approximately 100,000 years to recover.

In ocean waters with saturated calcium carbonate, shell deposition is optimal and therefore requires less energy, leaving more for reproduction and growth. As the water becomes slightly more acidic shell deposition may become more difficult, especially for larvae. As a result, more energy is spent on shell deposition and less on growth. Dr. Dickson reviewed the impact of CO_2 seeps in a small portion of the Mediterranean. Underwater photos show a huge reduction in diversity in the affected area.

In Oregon, oyster farms growing the larvae were periodically experiencing notable mortality. After careful study, it was determined that water used during certain up-welling events had a lower pH and was the source of the problem. By monitoring pH and management of the water quality, they were able to eliminate the problem.

What does the future hold? Dr. Dickson noted that is difficult to say, as variables such as water temperature, food availability, competition, and genetic flexibility all have important roles to play.

Following the exciting presentation, Carole Hertz won the shell drawing and the meeting was adjourned for further discussions with Dr. Dixon, and social time with refreshments provided by Bob Dees and Carole & Jules Hertz.

Paul Tuskes

Too Late for the Roster

MOGOLLON, VALENTIN, Roma 350, Lima 18, Peru, E-mail: svmogollon@yahoo.com and svalentinma@yahoo.com

An Apology

A generous donation to the 2012 Club auction by Bill Schramm was inadvertently left off the list of donors in the May issue of *The Festivus* for which we apologize. The beautiful cowry shell was gratefully accepted and appreciated.

A Big Thank You

You will notice that on page 73 of this issue there is a montage of many of the attendees at the recent Club's successful and fun auction/potluck. The photos on this plate were all taken by Wes Farmer who had also taken all the photos for the special meeting in March of this year. In fact, he's been the photographer for all our events for the past number of years. Wes never asks for any applause for the many things he does for the Club, and it is time that he is recognized for the wonderful photos he takes of our many events. We all thank you so much, Wes Farmer.

The Annual September Party

The big annual September party/potluck will once again be held at the home and garden of Debbie and Larry Catarius at 4173 Galt Street, San Diego, 92111. It will be on Saturday, September 22nd with the festivities beginning at 4 PM. More information will be forthcoming in future issues as the time gets closer and maps will be available on e-mail.

CLATHRODRILLIA PHASMA (SCHWENGEL, 1940) (GASTROPODA: DRILLIIDAE), AN EAST FLORIDA SPECIES REPORTED HEREIN FROM THREE QUADRANTS OF THE GULF OF MEXICO

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The genus *Clathrodrillia* has been placed in the family Drilliidae by recent authors (Bouchet & Rocroi, 2005; Tucker & Tenorio, 2009; Bouchet et al., 2011). *Clathrodrillia phasma* was originally placed by Schwengel (1940) in *Crassispira*, but this superficially similar taxon has a different type of radula and has been placed in Turridae by (Bouchet & Rocroi, 2005, and Tucker & Tenorio, 2009), and in Pseudomelatomidae, by Bouchet et al., 2011, a taxon the latter consider nomenclaturally valid for most genera previously placed in the "turrid" subfamily *Crassispirinae*.

The type locality for *Clathrodrillia phasma* is off Palm Beach, east Florida; to date the taxon has been reported only from east Florida (Rosenberg, 2009). However, in five cruises made in 2005, 2006, 2008 and 2011 in the Gulf of Mexico on the R/V Pelican (see García, 2007a, 2007b), we have collected 12 lots of *C. phasma*, now in my collection (EFG), with the following data:

MÉXICO: 20°51.16'N, 92°26.28'W, in 93-94 m, in granular sediment, 1 specimen (EFG 26112, fig. 1); 20°51.09'N, 92°27.10'W, in 124-94 m, in sediment, 1 specimen (EFG 26695, fig. 2); 20°51.49'N, 92°21.44'W, in 63-65 m, in sediment, 1 specimen (EFG 26532).

ALABAMA: 29°24.43'N, 87°58.63'W, in 74-72 m, in mud, 1 specimen (EFG 27706).

LOUISIANA: 28°04.147'N to 28°04.438'N, 91°46.845'W to 91°45.163'W, in 99.7 to 99.1 m, in mud, 2 specimens (EFG 28636, fig. 3); 28°06.78°N; 90°55.58°W, in 101-99 m, in mud, alive, 1 specimen (EFG 27905); 28°07.188'N, 90°52.812'W to 28°07.867'N, 90°49.896'W, in 116-117 m, in mud, 2 specimens (EFG 30161) and (EFG 30519, fig. 1); 29°20.683'N, 88°27.136'W to 29°20.883'N, 88°30.016'W, in 62-63 m, in shell hash, 1 specimen (EFG 30136); 29°16.245' N, 88°37.233' W to 29°08.900'N, 88°39.768'W, in 82-84 m, alive, 4 specimens (EFG 30172, fig. 4); 28°03.080'N to 28°02.623'N, 91°58.641'W to 91°056.393'W, in 101-100 m, in mud, 2 specimens (EFG 28643); 28°04.675°N to 28°05.020'N, 91°38.545'W to 91°36.140'W, in 100-104 m, in mud, alive, 1 specimen (EFG 28624); 28°05.009'N to 28°05.348'N, 91°11.365'W to 91°09.093'W, in 110-109 m, in mud, 4 specimens (EFG 28614).

Clathrodrillia phasma has been dredged in the northern Gulf of Mexico from 29°24'N to 28°04'N, and from 87°59'W to 91°59'W, at depths from 62-116 m; alive in 82-101 m, in mud and shell hash. In the southern Gulf of Mexico, it has been dredged at Bahía de Campeche in a rather limited area, from 20°51'N to 20°52'N and from 92°22'W to 92°27'W, in 63-124 m, in sediment. They were collected in only three of 115 dredge hauls. A specimen dredged in granular sediment in 93-94 m measures 32.7 mm (EFG 30519, fig. 1); the maximum reported size was 28 mm (Rosenberg, 2009).

I have two *Clathrodrillia* specimens from Isla Farallón, northeastern Panamá (09°05'N; 80°01' W) (EFG 30519, fig. 5) that are similar to *Clathrodrillia plasma*, but differ in having a more irregular spiral

ornamentation (compare enlargements in figs. 4a and 5a), a less produced anterior end, and in seemingly having a different protoconch (compare figs. 4b and 5c), However, the protoconch differences may be due to erosion, and other differences may be ecological in nature.

There is a similar species from Colombia reported by Yidi & Sarmiento (2011:130, fig.792) as "*Drillia* sp. 1", but it shows stronger, fewer axial ribs than those of *C. phasma* and *C. cf. phasma*, as well as a more conical shape. The most similar *Clathrodrillia* from the Panamic Province, *C. salvadorica* (Hertlein & Strong, 1971), is larger, more attenuate, and has an overall stronger ornamentation.

I thank the anonymous reviewer for the critical analysis of this work.

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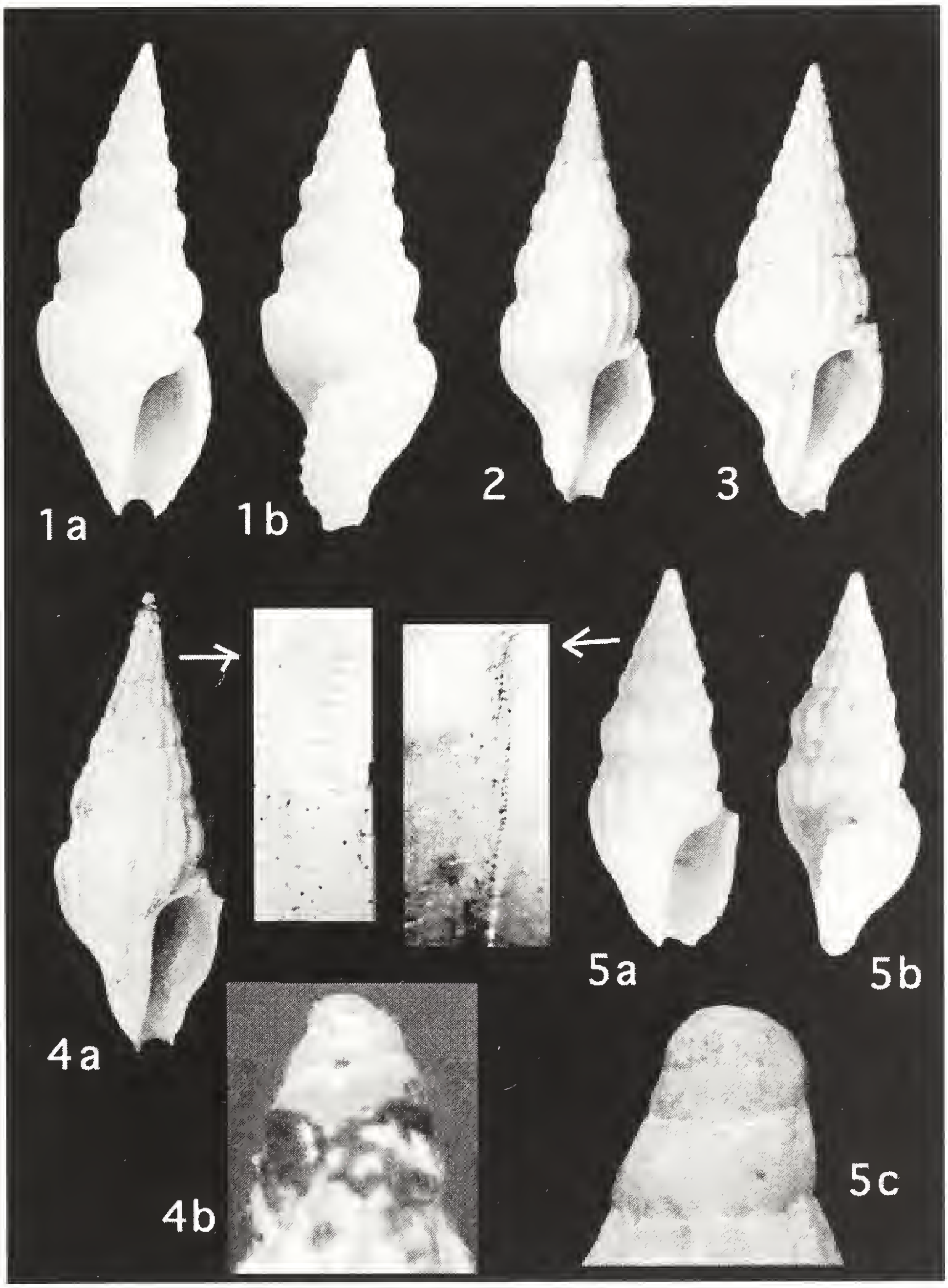

Figures 1-5.
1-4. *Clathrodrillia phasma*. MÉXICO, Bahía de Campeche: **(1)** 20°51.16'N, 92°26.28'W, in 93-94 m, 32.7 mm. **(2)** 20°51.49'N, 92°21.44'W, in 63-65 m, 21.5 mm. LOUISIANA: **(3)** 28°04.147'N to 28° 4.438'N, 91°46.845'W to 91°45.163'W, in 99.1-99.7 m, 23 mm. **(4)** 29°16.245'N, 88°37.233'W to 29°08.900'N, 88 °39.768'W, in 82-84 m, alive, 21.1 mm. **(5)** *Clathrodrillia* cf. *phasma*, NE PANAMÁ, Isla Farallón, 09°05'N, 80°01'W, 18.7 mm.

FURTHER SURVEYS OF THE MARINE MOLLUSK FAUNA OF THE ISLAND OF SAINT KITTS, LEEWARD ISLANDS, WEST INDIES, PART I

SUSAN J. HEWITT*

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Introduction

The island of Saint Kitts is situated at 16°45'N, 62°12'W, and is part of the inner arc of the northern half of the Leeward Island chain of the Lesser Antilles, West Indies (for map of the area, see Hewitt 2011a). St. Kitts is situated immediately north-northwest of the island of Nevis, which since 1997 has been my main focus of study during annual visits. I had previously searched Majors Bay on the tip of the southeastern peninsula of St. Kitts on four occasions (Hewitt 2011a, 2011b); this time I was able to search two new locations (Map 1) as well as a very brief search in Majors Bay.

Dr. Thomas Last, a friend who is Dean of Students at the University of Medicine and Health Services (UMHS) in St. Kitts, had kindly offered to drive me to look for shells. I requested a trip to the north end of the island, to see if I could find *Vasum globulus* Lamarck, 1816, there, across the channel from the island of Sint Eustatius, where that species appears to be quite common (Hewitt, 2010b).

On Friday April 29th my husband and I rode the main ferry from Charlestown, the capital of Nevis, over to Basseterre, the capital of St. Kitts. Dr. Last picked us up there and took us for a brief visit to the UMHS campus, which is 4 km west of the ferry port at Basseterre, on the western, or Caribbean, side of the island (see Map 1). At the south edge of the campus (17°17'35.5″N, 62°45'11.0″W), at the foot of low cliffs on the coastline which forms part of Camps Bay, Dr. Last pointed out a small beach (text figure 2) of "black sand" (actually brown volcanic grit). He said I might have good luck with shells there
because a coral reef offshore is in good condition, and

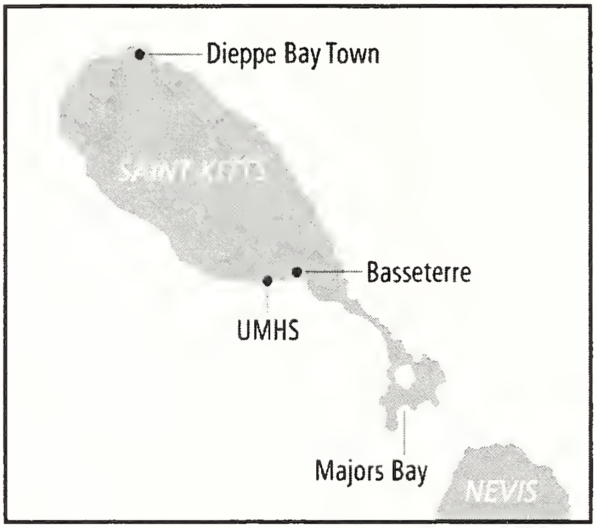

Figure 1. Map of the island of St. Kitts

because the beach is not accessible to the general public and therefore not picked over. He was correct. After 45 minutes of searching, I made the decision to return four days later so I could spend another two hours there. On April 29th, after the visit to the UMHS campus, Dr. Last drove us approximately 20 km north up the picturesque Atlantic (eastern) coast to Dieppe Bay Town, a small village in the extreme northeastern corner of the island. At the eastern end of Dieppe Bay there is a sandy point (17°25'05.2″N, 62°48'37.3″W), and immediately to the southeast there is a stretch of sand beach where a number of fishing boats were moored. To the southwest, in Dieppe Bay itself, there is an intertidal zone of boulders. The entire area is protected from the considerable force of the Atlantic surf by a fringing

Figure 2. View of the UMHS beach looking southwest. Image: Susan J. Hewitt.

Figure 3. View of the sand point at Dieppe Bay looking north. Image: Susan J. Hewitt.

coral reef offshore, visible in the distance as a line of breakers (text figure 3). Because of a sprained knee, I confined my search to the sandy area near the point; Dr. Last climbed over the boulders on the bay, looking for larger shells on my behalf.

When we returned to the car to leave, a boy from the village had set up a folding table with necklaces and a few beach-drift shells for sale. The type of wear on the shells and the selection of species were both very similar to those that Dr. Last and I had just collected, which made me confident that the boy's material was from Dieppe Bay, so I added to my list three species that the boy had found. We then drove west and made an unsuccessful attempt to find another access point; that part of the coast is lined with cliffs.

Results

The following table lists the species found on the UMHS beach on April 29th and May 3rd and in Dieppe Bay on April 29th. The material was found as dead shells or fragments in the beach drift, except for a number of intertidal species which were observed alive. Three species found in Majors Bay on May 8th are also listed at the end of the table. Families are listed in taxonomic order; gastropods following Bouchet and Rocrois (2005) and bivalves following Mikkelsen and Bieler (2007). Binomial epithets are taken from Rosenberg (2009). Species shown in boldface are new to the overall St. Kitts list, defined here as the Rosenberg (2009) Malacolog list plus the extra species listed in my two previous St. Kitts papers.

Table 1. Species found on the UMHS beach and Dieppe Bay

Notations used:
U = UMHS; D = Dieppe Bay; a = observed alive on intertidal rocks; w = very worn, b = broken; Ds = For sale on Dieppe Bay; Dso = For sale, shell very old and worn; M = already listed by Rosenberg (2009); **boldface** = new to the St. Kitts list

GASTROPODA		
Lottiidae		
Lottia morphotype B (as per Hewitt, 2009)	U	D
Lottia albicosta (C. B. Adams, 1845)	U	D
***Lottia leucopleura* (Gmelin, 1791)**	U	D
Patelloida pustulata (Heibling, 1779)	U	D
Tectura antillarum (Sowerby I, 1843)	U	Da
Fissurellidae		
Diodora arcuata (Sowerby II, 1862)	U	D
Diodora listeri (d'Orbigny, 1842)	U	–
***Fissurella nodosa* (Born, 1778)**	–	D
Fissurella rosea (Gmelin, 1791)	U	D
Diodora variegata Sowerby II, 1862	–	D
Diodora viridula (Lamarck, 1822)	U	–
Fissurella angusta (Gmelin, 1791)	U	D
Fissurella nimbosa Linnaeus, 1758	U	D
***Lucapinella limatula* (Reeve, 1850)**	U	–

Trochidae			
Cittarium pica (Linnaeus, 1758)	–	D	M
Tegula excavata (Lamarck, 1822)	U	D	
Tegula fasciata (Born, 1778)	U	–	
Tegula hotessieriana (d'Orbigny, 1842)	U	D	
Tegula lividomaculata **(C. B. Adams, 1845)**	U	D	
Turbinidae			
Astralium phoebium (Roding, 1798)	U	–	
Lithopoma tuber **(Linnaeus, 1767)**	U	D	
Turbo castanea Gmelin, 1791	U	–	
Turbo canaliculatus **Herrmann, 1781**	–	D	
Phasianellidae			
Eulithidium affine (C. B. Adams, 1850)	U	–	
Eulithidium bellum **(M. Smith, 1937)**	U	–	
Eulithidium tessellatum **(Potiez & Michaud, 1838)**	U	D	
Neritidae			
Nerita peloronta Linnaeus, 1758	Ua	–	
Nerita tessellata Gmelin, 1791	U	Da	
Nerita versicolor Gmelin, 1791	Ua	Da	
Puperita pupa **(Linnaeus, 1767)**	U	–	
Smaragdia viridis (Linnaeus, 1758)	–	D	
Cerithiidae			
Cerithium ?atratum (Born, 1778)	U	–	
Cerithium litteratum (Born, 1778)	U	D	
Cerithium lutosum Menke, 1828	U	D	
Planaxidae			
Hinea lineata (da Costa, 1778)	U	–	
Supplanaxis nucleus (Bruguiere, 1789)	U	Da	
Cypraeidae			
Erosaria acicularis **(Gmelin, 1791)**	U	Ds	
Macrocypraea zebra **(Linnaeus, 1758)**	U	–	
Talparia cinerea **(Gmelin, 1791)**	–	Ds	
Ovulidae			
Cyphoma gibbosum **(Linnaeus, 1758)**	U	–	
Cyphoma mcgintyi **Pilsbry, 1939**	U	–	
Littorinidae			
Cenchritis muricata **(Linnaeus, 1758)**	U	–	
Echinolittorina angustior (Morch, 1876)	Ua	–	
Echinolittorina meleagris (Potiez & Michaud, 1838)	U	–	
Echinolittorina tuberculata (Menke, 1828)	Ua	–	
Echinolittorina ziczac (Gmelin, 1791)	Ua	–	
Naticidae			
Naticarius canrena (Linnaeus, 1758)	U	–	
Polinices lacteus **(Guilding, 1834)**	U	–	
Rissoidae			
Rissoina decussata **Montagu, 1803**	U	–	
Strombidae			
Eustrombus gigas (Linnaeus, 1758)	U	Da	
Aliger costatus **(Gmelin, 1791)**	–	Da	
Strombus pugilis **Linnaeus, 1758**	U	D	
Tricornis raninus **(Gmelin, 1791)**	U	–	
Aliger gallus **(Linnaeus, 1758)**	–	Dso	
Tonnidae			
Cassis tuberosa (Linnaeus, 1758)	U	D	

Cypraecassis testiculus **(Linnaeus, 1758)**	–	D	
Semicassis cicatricosa (Gmelin, 1791)	U	–	M
Tonna pennata (Morch, 1852)	U	D	M
Bursidae			
Bursa granularis **(Roding, 1798)**	U	–	
Bursa rhodostoma thomae **d'Orbigny, 1847**	U	–	
Ranellidae			
Charonia variegata (Lamarck, 1816)	U	–	M
Cymatium femorale **(Linnaeus, 1758)**	U	–	
Cymatium labiosum (W. Wood, 1828)	U	–	M
Cymatium martinianum **(d'Orbigny, 1846)**	U	–	
Hipponicidae			
Cheilea equestris **(Linnaeus, 1758)**	U	–	
Hipponix antiquatus (Linnaeus, 1767)	U	–	
Hipponix incurvus **(Gmelin, 1791)**	–	D	
Hipponix subrufus (Lamarck, 1819)	U	D	
Triviidae			
Pusula pediculus (Linnaeus, 1758)	U	–	
Niveria quadripunctata **(J. E. Grey, 1827)**	U	–	
Niveria suffusa **(J. E. Grey, 1827)**	U	–	
Vermetidae			
Dendropoma corrodens **(d'Orbigny, 1842)** (on *Fissurella angusta* and *Hipponix subrufus*)	U	–	
Petaloconchus sp.	U	–	
Serpulorbis decussatus **(Gmelin, 1791)**	U	D	
Epitoniidae			
Epitonium lamellosum **(Lamarck, 1822)**	U	–	
Epitonium albidum **(d'Orbigny, 1842)**	U	–	
Buccinidae			
Engina turbinella **(Kiener, 1835)**	U	–	
Pisania pusio **(Linnaeus, 1758)**	U	–	
Gemophos tinctus **(Conrad, 1846)**	U	–	
Columbellidae			
Columbella mercatoria (Linnaeus, 1758)	U	D	
Zafrona pulchella **(Blainville, 1829)**	U	–	
Nitidella nitida (Lamarck, 1822)	U	D	
Nitidella ocellata (Gmelin, 1791)	U	D	
Rhombinella laevigata **(Linnaeus, 1758)**	U	D	
Fasciolariidae			
Leucozonia nassa **(Gmelin, 1791)**	U	–	
Leucozonia ocellata **(Gmelin, 1791)**	U	–	
Dolicholatirus sp.	U	–	
Nassariidae			
Nassarius antillarum **(d'Orbigny, 1847)**	U	D	
Muricidae			
Coralliophila caribaea **Abbott, 1958**	U	–	
Favartia alveata **(Kiener, 1842)**	U	–	
Plicopurpura patula **(Linnaeus, 1758)**	–	D	
Mancinella deltoidea (Lamarck, 1822)	U	D	
Stramonita rustica **(Lamarck, 1822)**	U	Da	
Costellariidae			
Vexillum puella **(Reeve, 1845)**	U	–	
Vexillum sp. (either *cubanum* or *hendersoni*)	Uw	–	
Vexillum dermestinum **(Lamarck, 1811)**	U	–	
Vexillum sykesi **(Melvill, 1925)**	U	–	

Harpidae		
***Morum oniscus* (Linnaeus, 1767)**	U	–
Mitridae		
Mitra barbadensis (Gmelin, 1791)	U	–
***Mitra nodulosa* (Gmelin, 1791)**	U	–
Olividae		
Oliva reticularis Lamarck, 1791	U	–
Olivellidae		
Jaspidella sp.	–	Db
Olivella exilis (Marrat, 1868)	U	–
***Olivella nivea* (Gmelin, 1791)**	U	–
Mangeliidae (see Bouchet et al., 2011)		
Agathotoma sp.	U	–
Conidae		
***Conus daucus* Hwass, 1792**	U	–
Conus mus Hwass, 1792	U	D
***Conus regius* Gmelin, 1791**	U	D
Drilliidae		
***Drillia cydia* (Bartsch, 1943)**	Uw	–
Strictispiridae		
***Strictispira ?paxillus* (Reeve, 1845)**	Uw	–
Strictispira sp.	U	–
Pseudomelatomidae (see Bouchet et al., 2011)		
***Crassispira fuscescens* (Reeve, 1843)**	U	–
***Pilsbryspira albocincta* (C. B. Adams, 1845)**	U	–
***Pilsbryspira leucocyma* (Dall, 1884)**	U	–
Cancellariidae		
***Tritonoharpa lanceolata* (Menke, 1828)**	U	–
Architectonicidae		
Architectonica nobilis Roding, 1798	U	–
Bullidae		
Bulla occidentalis A. Adams, 1850	U	D
Ellobiidae		
***Melampus monile* (Bruguiere, 1789)**	U	–

BIVALVIA

Arcidae		
Acar domingensis (Lamarck, 1819)	U	D
Arca imbricata (Bruguiere, 1789)	U	–
Barbatia cancellaria (Lamarck, 1819)	U	D
***Cucullaearca candida* (Heibling, 1779)**	U	D
***Fugleria tenera* (C. B. Adams, 1845)**	–	D
Noetiidae		
Arcopsis adamsi (Dall, 1886)	U	D
Glycymerididae		
***Glycymeris decussata* (Linnaeus, 1758)**	U	–
***Glycymeris undata* (Linnaeus, 1758)**	U	–
Tucetona pectinata (Gmelin, 1791)	U	–
Mytilidae		
Brachidontes exustus (Linnaeus, 1758)	U	–
Pteriidae		
***Pinctata imbricata* Roding, 1798**	U	–
Isognomonidae		
***Isognomon bicolor* (C. B. Adams, 1845)**	U	–
***Isognomon radiatus* (Anton, 1839)**	U	D
Pinnidae		
***Pinna carnea* Gmelin, 1791**	–	D
Limidae		
Ctenoides mitis (Lamarck, 1807)	U	–
Ctenoides scabra (Born, 1778)	U	D
Ostreidae		
Dendrostrea frons (Linnaeus, 1758)	U	–
Plicatulidae		
Plicatula gibbosa Lamarck, 1801	U	–
Pectinidae		
Caribachlamys nucleus (Reeve, 1853)	U	D
Spondylidae		
Spondylus ictericus Reeve, 1856	U	–
Lucinidae		
Ctena orbiculata (Montagu, 1808)	U	D
***Codakia orbicularis* (Linnaeus, 1758)**	U	D
Chamidae		
Chama florida Lamarck, 1819	U	–
Chama congregata Conrad, 1833	U	–
***Chama macerophylla* Gmelin, 1791**	U	–
***Chama sarda* Reeve, 1847**	U	–
***Chama sinuosa* Broderip, 1836**	U	–
Cardiidae		
***Acrosterigma magnum* (Linnaeus, 1758)**	U	–
Americardia media (Linnaeus, 1758)	U	–
Laevicardium sp.	U	–
Veneridae		
***Chione cancellata* (Linnaeus, 1767)**	U	–
Gouldia cerina (C. B. Adams, 1845)	U	–
Lirophora paphia (Linnaeus, 1767)	U	–
Macrocallista maculata (Linnaeus, 1758)	U	–
Timoclea pygmaea (Lamarck, 1818)	U	D
Tellinidae		
Arcopagia fausta (Pulteney, 1799)	U	–
Strigilla mirabilis (Philippi, 1841)	–	D
Semelidae		
***Semele proficua* (Pulterney, 1799)**	U	–
Corbulidae		
Varicorbula sp.	U	–

POLYPLACOPHORA

Ischnochitonidae		
Stenoplax sp. (one plate)	U	–
Chitonidae		
***Chiton marmoratus* Gmelin, 1791**	U	–
Chiton tuberculatus Linnaeus, 1758	U	D

Species found on Majors Bay, May 8th 2011

- New to the St. Kitts list:
  Muricidae, ***Phyllonotus pomum* (Gmelin, 1791)**
  Conidae, ***Conus spurius* (Gmelin, 1791)**
- New to the Majors Bay list:
  Cardiidae, *Americardia media* (Linnaeus, 1758)

Remarks

The beach at UMHS is composed of rock granules and fine gravel rather than sand, and as a result very few micromollusks were found, and some of the beach-drift shells were polished so much that they were difficult to identify. Nonetheless, I found a rich fauna of 146 taxa, 5 of which were seen alive. During my first visit, 45 minutes of searching produced 78 species; the two-hour follow-up visit added another 67 species. Three interesting new taxa for the St. Kitts list from this locality are the costellariids *Vexillum puella, V. dermestinum* and *V. sykesi*. Another *Vexillum* species was represented by two extremely worn shells with the cream and brown color bands that are characteristic of both *V. hendersoni* (Dall, 1927) and *V. cubanum* Aguayo & Rehder, 1936.

I found one worn shell that resembled a *Teralatirus*, and Bill Lyons commented (via email, July 2011), "I think this is a specimen of an unnamed species of *Dolicholatirus* that ranges from the Lesser Antilles to Colombia." For unknown reasons, at the UMHS beach, the color patterns on the shells of *Oliva reticularis*, and *Olivella exilis* were exceptionally dark, and so was the overall shell color of *Serpulorbis decussatus*.

The search further north at Dieppe Bay yielded 60 taxa. Seven of these are listed here as "live", however the *Stramonita rustica* had washed up moribund, two subadult shells of *Eustrombus gigas* had washed up after having been fished live, and six *Aliger costatus* had been taken live and then broken into pieces on the shore next to the fishing boats. In the boulder area of Dieppe Bay, Dr. Last found two shells of *Turbo canaliculatus*; this is a deeper-water taxon that is an uncommon beach find. Fourteen species present at Dieppe Bay were not found at UMHS, and 10 of those were new to the St. Kitts list. No evidence of *Vasum globulus* was discovered.

The 10-minute search at Majors Bay on May 8th demonstrated that the list for that bay will probably continue to expand; the development plans mentioned in Hewitt (2011b) have not been realized as yet.

Conclusions

Prior to this paper, the total number of taxa reported from St. Kitts in the literature was 170, consisting of 35 species listed by Rosenberg (2009), and 135 by Hewitt (2011a; 2011b). During the 2011 visits to St. Kitts, 82 additional species were found, raising the St. Kitts total to 252. The list for St. Kitts was expanded rapidly and relatively easily, primarily because the beach at UMHS was an exceptionally rich location for beach-drift shells.

Acknowledgments

Sincere thanks go to Dr. Thomas Last, Dean of Students at UMHS, without whom this research would not have been possible. Dr. Harry G. Lee generously provided a great deal of help with numerous difficult determinations. An image of the *Dolicholatirus* was viewed and identified to genus by Mr. William G. Lyons, formerly of the Florida Department of Natural Resources Marine Laboratory, St. Petersburg, Florida. My husband Ed Subitzky helped with compiling the species list and copy-editing the paper. The information from Dr. Gary Rosenberg's database Malacolog 4.1.1 is provided with the permission of the ANSP.

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A pictorial view of the fun at the recent San Diego Shell Club Auction/Potluck

Top row: Bob Dees, Ann Tuskes & Vân Dees, Silvana Vollero & Daniel; Second row" Carole Hertz, Rick Negus and all at auction table, Dave Waller & Bill Schramm; Third row: John LaGrange, Paul Kanner, Paul Tuskes & Don Pisor, Duffy Daughenbaugh, Third row center: Don Pisor, Alex Sassi & Jules Hertz, Paul Tuskes; Bottom row: Marty Schuler & Dave Berschauer, Ginny & Richard Herrmann & Larry Buck, Jeanne Pisor & Debbie Catarius, John LaGrange & Chuck Reitz.

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Meeting date: third Thursday, 7:30 PM,
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PROGRAM

CALIFORNIA SHELLS, PART TWO

Paul Tuskes will present Part 2 of his terrific discussion of California shells. This presentation will include photos of live animals in their habitats and material from collections. It will cover the ovulids, cypraeids, mitrids, nassariids, olivids, cancellariids and turrids.

Meeting date: July 19th at 7:30 PM

CONTENTS

Club news....76
Terrestrial snails from an urban park in Vancouver, British Columbia
ROBERT G. FORSYTH & PATRICK WILLISTON 77
Relative abundance of marine mollusk shells in the beach drift on Sanibel Island, Lee County, Florida, USA
SUSAN J. HEWITT....81

CLUB NEWS

San Diego Shell Club Meeting
21 June 2012

The meeting was called to order at 7:40 PM by Bob Dees. The previous minutes were approved and the Treasurer's report was accepted. Carole Hertz reminded members that *The Festivus* is accepting papers. Wes Farmer donated some books/papers that were sold at the meeting.

Bob Dees introduced Shawn Wiedrick, who talked about his experiences on Aruba. Aruba is located off the northeastern tip of Venezuela and has surprising little rainfall. Shawn is especially interested in micro shells and shared his collecting and sorting methods. A hand net is used to sweep through eel grass, algae, rubble, gravel or sand. Large items are removed from the net and the remaining material is dried and then sorted during the evening. Material is labeled by location, substrate and depth. Shawn had excellent photos of shells that ranged from 3 to 15 mm, a number of which are new species.

Having used sets of sieves to sort material, I know how impractical they are to pack. Shawn cuts small circles out of various grades of wire mesh. When he arrives on site he cuts the bottom out of plastic beer glasses and inserts the mesh. Largest mesh is placed in the top cup and smaller mesh in the bottom cup. The cups are stacked, debris is placed in the top cup and water used to move material through the sieves. I don't think we were told what he did with the beer that was initially in the cups.

Another important suggestion he shared is the use of Google Earth to view your sites before you arrive. Last, there are issues with paperwork. Even micro shells are covered by CITES and you may be required to have a collecting permit from the country of origin, a permit from the country to transport the shells back to the USA, and a permit form USFWS for the entry of the shells. It was an interesting talk, great photos, and some important collecting tips.

The shell drawing was won by Bruce Kemp and the meeting was adjourned at 8:45 PM. Refreshments were provided by Silvana Vollero, Carole and Jules Hertz and Evelyn and Don Smith.

Paul Tuskes

Arranging for the Shells of the Recent Survey of Mission Bay Mollusks to be incorporated in the Scripps Institution of Oceanography's Collection

During the San Diego Shell Club's recent project *Survey of Mission Bay Mollusks, San Diego, California*, during 2008-2010, Paul M. Tuskes was the lead investigator with many of the Club members participating. This project's results were published in *The Festivus* in February 2012.

During the study, Dr. Greg Rouse, of Scripps Institution of Oceanography, expressed an interest in housing the collected material from the project once the results were published. The SDSC Board of Directors has since been in communication with Dr. Rouse, and he is still interested in maintaining the collection of mollusks from this Survey.

It is hoped that those members who collected material for the project will be willing to donate their material to the Scripps Collection.

Carole Hertz and Paul Tuskes have agreed to take on the task of gathering this material, making standardized labels and inventorying the collection. This collection will document species that are known to occur in the bay, both currently and in the recent past. If you have material to donate, either bring it to the July meeting or contact Carole or Paul to make other arrangements. Please be sure to identify your material and give as much collecting data as you have, so you can be recognized on the data label.

This can be a valuable asset to future workers involved in studies of Mission Bay, who will be able to check the validity of the material published in the 2008-2010 study in *The Festivus*.

The Annual September Party

The big annual September party/potluck will once again be held at the home and garden of Debbie and Larry Catarius at 4173 Galt Street, San Diego, 92111. It will be on Saturday, September 22nd with the festivities beginning at 4 PM. More information will be forthcoming in future issues as the time gets closer and maps will be available via e-mail.

TERRESTRIAL SNAILS FROM AN URBAN PARK IN VANCOUVER, BRITISH COLUMBIA

ROBERT G. FORSYTH[1] AND PATRICK WILLISTON[2]

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Introduction

The cities and surrounding suburbs of Vancouver and Victoria have been more comprehensively surveyed for land snails and slugs than most urban places in Canada. In particular, searches from dozens of sites targeting introduced terrestrial molluscs have resulted in new records for these cities, the province, and in some instances, new records for Canada or North America (Forsyth 1999; Reise et al. 2000; Forsyth 2001; Forsyth et al. 2001). However, all of these searches were made by collecting individual snails by hand; litter-dwelling microsnails (< 5 mm) may have been overlooked in some instances.

We report here the results of sampling leaf litter collected in Queen Elizabeth Park, a 52.78-hectare green space in the city of Vancouver (Vancouver Board of Parks and Recreation 2011). Although no native forest remains, and garden areas (now decades old and mature) are planted with ornamental trees and shrubs, we found three native species of snails. We also verify recent finds in the park (Holm 2010) of *Carychium tridentatum* (Risso, 1826) and *Discus rotundatus* (Muller, 1774) and report an additional nearby site for *D. rotundatus* as well as discuss an historical record.

Materials and Methods

All of the material presented here was collected by P. Williston with help from Chloe Williston. Land snails initially were found in Queen Elizabeth Park by hand searching leaf litter in the field (28 December 2010). A collation of litter samples was gathered from random spots throughout the gardens on 7–8 January 2011, and a series of litter samples of differing tree species (maple, *Acer* sp.; oak, *Quercus* sp.; sycamore, *Acer pseudoplatanus*; and European beech, *Fagus sylvatica*) were later collected on 2 March 2011. The volume of litter per sample was approximately 2 L, except for the beech litter sample that was approximately 4 L. The litter samples were dried, sieved to remove the coarsest material, and hand sorted by R. Forsyth, who also identified the snail species. The center of the area sampled is approximately at 49° 14′ 33″N, 123° 06′ 50″W.

Terrestrial snails were collected by hand at an additional site, approximately 1 km from the park in a residential neighborhood (11 May 2010 and observed at other times): 515 East 31st Street, Vancouver, 49° 14′ 35.26″N, 123° 05′ 37.00″W.

All specimens are in the Forsyth Collection and records are mapped online (Klinkenberg 2011). Photographs were taken through Nikon Coolpix 950 or 995 digital cameras mounted to one eyepiece of a Russian-built stereoscope (МБС-10) using an adapter manufactured by Zarf Enterprises (Spokane, Washington). For each shell view, a series of photos were taken through the depth of field and processed using focus stacking software (Helcion Focus 5.2).

Results and Discussion

Eleven species of land snails were collected by hand or in litter samples from Queen Elizabeth Park (Table 1). *Aegopinella nitidula* (Draparnaud, 1805) (Figs. 16–18), *Carychium tridentatum* (Figs. 7–9), *Discus rotundatus* (Figs. 22-24), *Lauria cylindracea* (Da Costa, 1778) (Figs. 1–3), *Oxychilus alliarius* (Miller, 1822), *Vallonia excentrica* Sterki, 1893, and *Vitrea contracta* (Westerlund, 1871) (Figs. 13–15) are introduced European species. *Cochlicopa lubrica* (Muller, 1774) (Figs. 4–6) is strongly synanthropic and some populations may represent introductions (Forsyth 2004).

Punctum randolphii (Dall, 1895) (Figs. 10–12) and *Striatura pugetensis* (Dall, 1895) (Figs. 19–20) belong to the native fauna and are common components of litter-dwelling malacofauna in southwest British Columbia. It is a little surprising to find these two native, forest-dwelling microsnails in an urban park with highly modified habitats and this shows that there is value in litter sampling even urban habitats for microsnails that otherwise might be overlooked. It is impossible to know if these populations *Punctum randolphii* and *Striatura pugetensis* are remnants of a time when the city was forest or if they were re-established by passive dispersal. *Vitrina pellucida* (Muller, 1774) is a third native species that occupies a broad range of more-or-less open and sometimes modified habitats, such as roadsides (Forsyth 2004).

Two species, *Aegopinella nitidula* and *Lauria cylindracea,* were recovered from all our litter samples, and *L. cylindracea* was by far the most common species. Our 2 March 2011 litter collections sampled the ground below four tree species, and although litter sampling is often utilized as a means to quantitatively record microsnails (Coppolino 2010), too many other unknown factors could be at play (moisture, litter depth, exposure, chance, etc.) to infer preference by snails to a particular tree species. We had speculated that *Carychium tridentatum* would be found in damp beech litter as described by Morton (1954); however our specimens inhabited the understory of oak trees.

We coincidentally found two species, *Carychium tridentatum* and *Discus rotundatus,* which were only recently recorded from Queen Elizabeth Park by Holm (2010). Both of these species were missed during earlier surveys for introduced snails in the Vancouver and Victoria regions from 1989 to 2003 (Forsyth 1999 and unpublished). *Discus rotundatus* was purportedly first found in B.C. at Esquimalt (a suburb of Victoria), Vancouver Island on 20 December 1954, by D. Monty Wood (Forsyth 2004; Grimm et al. 2010; Canadian Museum of Nature, Ottawa, CMNML 91841). However, Dr. Wood (personal communication, November 2011) has no recollection of having been in B.C. in December 1954 and believes the museum labels are in error. *Discus rotundatus* is, therefore, unconfirmed from Vancouver Island.

Discus rotundatus seems more restricted than many other introduced species of snails in southwest British Columbia. Recent collections are all near Queen Elizabeth Park. We now have records approximately 1 km east of the park on the north side of the 500 block of East 31st Street. *Discus rotundatus* was also found in the adjacent alleyway with *Cepaea nemoralis* (Linnaeus, 1758), *Aegopinella nitidula* and *Oxychilus alliarius* on soil and asphalt beneath lavender shrubs (*Lavandula* sp.), and in soil among the ornamental cobbles beneath Douglas-fir trees (*Pseudotsuga menziesii*) on the south side of the 500 block of East 30th Street. Repeated observations were made at this last location of many (more than 20) *D. rotundatus* on the surfaces of cobbles and on a stone retaining wall on the days following rainfall events.

Acknowledgments

We thank Chloe Williston, at the time age 4, for her sharp eyes and keen interest in finding these and other snails. Dr. Jean-Marc Gagnon (Chief Collections Manager, Canadian Museum of Nature, Gatineau, Quebec) and Dr. D. Monty Wood (Honorary Research Associate, Canadian National Collection of Insects, Ottawa, Ontario) answered our queries about the purported Vancouver Island record of *Discus rotundatus.*

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Figures 1–24. Land snails from Queen Elizabeth Park, Vancouver, British Columbia. **1–3**, *Lauria cylindracea*, height 3.75 mm; **4**, *Cochlicopa lubrica*, height 5.85 mm; **5**, *C. lubrica*, height 5.05 mm; **6**, *C. lubrica*, height 4.55 mm; **7–9**, *Carychium tridentatum*, height: 2.0 mm (with detail of aperture); **10–12**, *Punctum randolphii*, width 1.45 mm; **13–15**, *Vitrea contracta*, width 2.15 mm; **16–18**, *Aegopinella nitidula*, width 7.2 mm; **19–21**, *Striatura pugetensis*, width 1.8 mm; **22–24**, *Discus rotundatus*, width 5.2 mm.

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	Hand-collected: 28 Dec. 2010	**Litter sample: 7–8 Jan. 2011**	**Litter samples: 2 Mar. 2011**			
			Maple	**Oak**	**Sycamore**	**Beech**
Aegopinella nitidula (Figs. 16–18)	12	1	2	1	1	3
Carychium tridentatum (Figs. 7–9)		1		1		
Cochlicopa lubrica (Figs. 4–6)		5		1	1	1
Discus rotundatus (Figs. 22–24)	3					
Lauria cylindracea (Figs. 1–3)	2	114	21	4	3	139
Oxychilus alliarius		1				3
Punctum randolphii (Figs. 10–12)		1		2		15
Striatura pugetensis (Figs. 19–20)		1				3
Vallonia excentrica				1		
Vitrea contracta (Figs. 13–15)		1		1		2
Vitrina pellucida	1					

Table 1. Species and quantities of land snails recovered from leaf litter samples taken in Queen Elizabeth Park. The volume of litter for each sample was approximately 2 L (4 L for the beech sample).

RELATIVE ABUNDANCE OF MARINE MOLLUSK SHELLS IN THE BEACH DRIFT ON SANIBEL ISLAND, LEE COUNTY, FLORIDA, USA

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Introduction

Sanibel Island is a barrier island off southern Florida in the Gulf of Mexico located at 26°26′23″N, 82°4′50″W. The nearest major city is Fort Myers. Sanibel is the larger and more southerly part of an ancient sandbar that also includes the island of Captiva. Lying north of Sanibel and Captiva are two more sand-barrier islands, North Captiva and Cayo Costa. Running parallel to the east of the barrier islands is Pine Island, which is geologically part of the mainland. The most striking feature of the mainland in this area is the large tidal estuary of the Caloosahatchee River, which empties into San Carlos Bay, which in turn faces out into the Gulf just beyond the eastern tip of Sanibel.

In 1926, Sanibel and Captiva were separated into two islands by storm surge from a hurricane. The water channel that opened between them became known as "Blind Pass." However, on the Gulf (or western) side, the entrance to this channel does not stay open: sand bars form and gradually close the entrance, joining the two islands with a sand-spit. The entrance to the Blind Pass channel was opened by a storm in the late 1990s, was opened again very briefly by Hurricane Charley in 2004, and was opened by dredging in 2009 (personal e-mail communication from Mike Mullins in 2012). The entrance to Blind Pass is however currently sealed over again by sand.

The beaches of Sanibel and Captiva are well-known for frequent and substantial accumulations of seashells. The islands are surrounded underwater by extensive sand ramps facing south and west; these allow waves to roll shells up onto the beach whenever the wind direction is favorable. As a result, Sanibel has become world famous as a shelling destination and attracts an exceptionally large number of shell collectors, both as residents and as visitors. No live collecting of invertebrates is allowed, not even shells occupied by hermit crabs; only empty shells may be taken. The island is home to the Bailey-Matthews Shell Museum (BMSM), the only museum in the USA devoted entirely to shells. Despite all of this focused interest, it appears that no studies have been carried out to determine the most common species in the beach drift at Sanibel.

The marine mollusk fauna of Sanibel is subtropical, containing some elements that are also found in the Caribbean, the Carolinian, and even the Boreal faunas. Being situated on the Gulf of Mexico, Sanibel's fauna is slightly different from that of the corresponding part of the Atlantic coast of Florida. In the year 2000, the director of the Bailey-Matthews Shell Museum, Dr. Jose Leal, started an online illustrated database of southwest Florida marine mollusk shells, listing confirmed species known from that area, with special emphasis on Sanibel. The database is frequently updated (Leal, 2012). Books include Mikkelsen & Bieler (2005), a superb resource for identification of southern Florida bivalves, and Hartmann (2006), a useful small handbook covering 167 common species of Florida bivalves.

I visited Sanibel Island from December 7-19 2011, staying at the Blue Dolphin Cottages next to Beach Access Point #7 on West Gulf Drive (26°26'11.72"N, 82°07'32.75"W). After four days of hand-picking beach drift in the general area, I visited Dr. Leal at the shell museum. While there I mentioned that before coming to Sanibel I had wondered what the most abundant species were in the beach drift. Dr. Leal and I had independently guessed at what the single most common species might be. I decided to carry out what would, by necessity, be a small and simple study of relative species abundance, but I also

continued to observe live mollusks during low tide, and to hand pick the voluminous beach drift on West Gulf Drive, hoping to understand the fauna of the area.

As is true for many sandy beaches worldwide, the drift on Sanibel consists primarily of bivalves. Far more bivalves than gastropods live in sand or on sand. Bivalves that need to cement themselves often colonize dead shells and shell fragments. Many marine gastropod species prefer a hard substrate and there is only a small amount of rock and coral habitat around Sanibel.

Beach drift: limitations and biases

Anyone who frequently examines the same beach at different times will know that drift varies in composition from day to day, season to season, and one year to the next. It can also vary from one part of a beach to another.

Drift is a death assemblage, and therefore it cannot be expected to accurately reflect the relative abundance of live species in situ. Predators sometimes damage the shells of living mollusks, but in cases where a shell is intact before it washes up, it may still get broken before it reaches the drift line, depending upon how robust it is. Day after day shells are rolled around by waves, and fragile shells can easily be crushed in collisions with stronger and heavier ones. In contrast, shells that are thick and solid may remain whole and readily identifiable over long periods of time. This differential attrition can mean that in beach drift some species are over-represented and others under-represented. Such processes are part of taphonomy, the study of how organisms decay over time, a subject more familiar to paleontologists than to students of living Mollusca.

In most cases, the two valves that make up the shell of a bivalve come apart after death. Because of this, even in a hypothetical situation where numbers of live gastropods and bivalves were exactly equal, after death there would typically be twice as many bivalve valves as gastropod shells, and this can appear to exaggerate the presence of bivalves.

The large shell heaps that sometimes form on Sanibel beaches have been significantly sorted by wave action, with larger shells being deposited at the summit and on the surface of the pile, and fragments and smaller shells ending up further down the slopes and deeper into the pile. Size and shape can determine how many valves of a species fit into a certain volume, including the 5-liter tub that was used in my study as a standard sampling device. For example, valves of *Anadara transversa* (Say, 1822) are shaped in such a way that they tend to pack in a dense array, and therefore a large number can occupy a relatively small volume. In contrast, valves of *Noetia ponderosa* (Say, 1822), as well as being larger, are of a strikingly asymmetrical shape, and do not stack in close arrays.

In addition to such natural factors, drift on Sanibel has been "combed" by humans. Every day on almost every beach on the island, people are finding and carrying away numerous shells of the more attractive species. Of the common bivalves, the most colorful of the calico scallops, *Argopecten gibbus* (Linnaeus, 1758), are picked up, and also some *Carditamera floridana* Conrad, 1846, which are useful to shell crafters. Fortunately for this study, many of the other abundant species are of little interest to the average collector because of their plain appearance.

Despite considerations like these, differences in species counts were large enough to give fairly clear indications of the most abundant marine mollusk shells on the island.

Methods

Although the surface of the Gulf was calm on the afternoon we arrived, overnight there was a rainstorm with 32 kph winds. A large shell pile formed about 1 km north of where we were staying (Figure 1). On December 13th, a 5-liter sample was taken from one

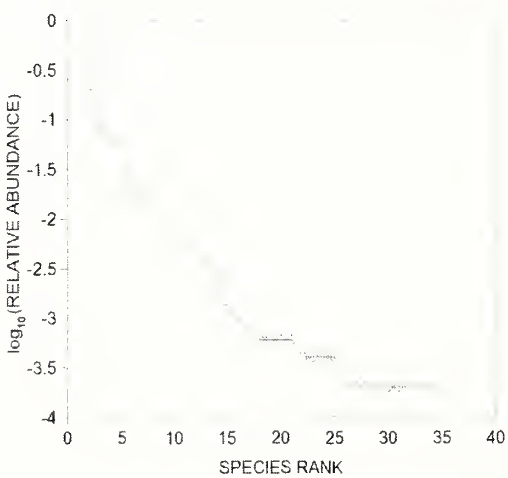

Figure 1. Whittaker plot totals for bivalves over all four localities.

side about 30 cm below the top of this pile. The next morning the pile had reformed into two smaller piles, with the second a little further north in the same area), and a 5-liter sample was taken from the top of the second pile.

I asked my friend Pamela Rambo of Sanibel if she could get me shell material from Turner Beach near Blind Pass at the northwestern end of Sanibel. I also asked her for material from Lighthouse Beach on the eastern tip of the island, where shells wash up from the Gulf to the south, as well as from San Carlos Bay to the north (a sheltered bay southwest of Fort Myers near the mouth of the Caloosahatchee River). On the 14^{th}, Pam scooped a bucketful from the largest drift line at Turner Beach and on the 15^{th}, she scooped one-third of a bucket from the largest drift line at Lighthouse Beach.

Using 5-liter samples from each locality, I sorted the shells and determined the numbers for each species. Only valves that were more than 50% whole were included in the count. Each single valve of a bivalve was counted as 1, even on the rare occasions when it was connected (this was only the case for *Donax variabilis).* Each gastropod shell that was more than 50% whole was counted as 1. The sizes of the shells in the samples ranged from approximately 60 mm down to 5 mm; there appeared to be no shells of micromollusks smaller than that. After sorting each sample, I made a rough estimate of the residue (shell fragments and sand) as a percentage of the whole 5-liter volume.

Analysis

Anadara transversa was the most common species overall as Jose and I had suspected. The six commonest bivalves over all the samples were *Anadara transversa, Chione elevata, Noetia ponderosa, Plicatula gibbosa, Donax variabilis,* and *Anomia simplex (*Figure 2). Of the list of 35 bivalves, the majority 23, are infaunal and 6 are cemented species: *Plicatula gibbosa, Anomia simplex. Ostrea equestris, Chama congregate, Crassostrea virginica* and *Pododesmus rudis.* The chamid *Arcinella cornuta* starts life attached, but subsequently becomes free. The 3 pectinids are free swimmers. The 2 arcids create a byssus, but can move around when needed.

The two samples from West Gulf Drive Beach, WGD1 and WGD2, showed a few differences. These may have resulted because WGD1 was taken from the side of a pile whereas WGD2 was from the top of a pile and therefore contained no small shells such as *Donax variabilis.*

In the Turner Beach sample,TBBP, *Chione elevata* outnumbered *Anadara transversa* by a small margin; this was the only one of the samples where *C. elevata* was the most abundant species. *Plicatula gibbosa* was more common at Turner Beach than anywhere else. Seven species were present there (as 1 to 4 valves) that were not present in any of the other samples: *Abra aequalis, Anomalocardia cuneimeris, Crassinella lunulata, Pododesmus rudis, Laevicardium pictum, Lusciniscа nassula* and *Transennella conradina.* Indeed, the Turner Beach sample had the highest overall diversity, with 25 species and this was despite the fact that half of that sample was discarded as a mixture of shell fragments and sand.

In the Lighthouse Beach sample, LIHO, the number of valves of *Anadara transvera* was well over 1,000. The total for this species greatly outnumbered any other at that locality. It was also a higher count for one species than was found in any other sample. *Chione elevata* was the second most common species in the LIHO sample with 328, and *Donax variabilis* was third at 267, substantially more common here than in the other localities. Also unlike the other samples, LIHO included 6 valves of *Mulinia lateralis*, a small species which lives in soft sediment in back bay and estuarine habitats.

Eleven species of bivalves were present in all four samples: *Anadara transversa, Anomia simplex, Arcinella cornuta, Argopecten gibbus, Carditamera floridana, Chione elevata, Crassostrea virginica, Noetia ponderosa, Ostrea equestris, Plicatula gibbosa* and *Trachycardium egmontianum.*

The most common gastropod in each of the samples was *Crepidula fornicata.* As well as being the most abundant gastropod, it was the sixth most common species of mollusk found. It was most abundant in the Lighthouse Beach sample with 41 shells. The second most common gastropod overall was white with flat shells belonging to the genus *Crepidula.* Both *C. atrasolea* R. Collin, 2000, and *C. depressa* Say, 1822, occur in Florida, and they cannot be differentiated solely by shell characteristics.

If circumstances had allowed sampling from other habitats on the island such as the bay side additional species would almost certainly have been present.

Table 1. Numbers for all the taxa in the four samples (listed in order of their overall totals, see last column)

Abbreviations for the four samples: WGD1 = the first sample from West Gulf Drive, 1 km north of Beach Access point #7, Dec 13th 2011; taken from the surface, 30cm down the land side of the heap, 20% discarded as shell fragments, no sand. **WGD2** = the second sample from West Gulf Drive, a short distance north of where sample 1 was taken, Dec 14th 2011; taken from top of heap, 10% discarded as shell fragments, no sand. **TBBP** = the sample from Turner Beach at Blind Pass, Dec 14th 2011; taken from largest drift line, 50% discarded as a mixture of shell fragments and sand. **LIHO** = the sample from Lighthouse Beach, Dec 15th 2011; taken from the largest drift line, 20% discarded as a mixture of shell fragments and sand. **TOTAL** = overall total for each of the species

BIVALVIA (individual valves)	WGD1	WGD2	TBBP	LIHO	TOTAL
Anadara transversa (Say, 1822)	538	283	420	1,149	2390
Chione elevata (Say, 1822)	226	68	475	328	1097
Noetia ponderosa (Say, 1822)	97	198	57	70	422
Plicatula gibbosa Lamarck, 1801	62	15	196	37	310
Donax variabilis (Say, 1822)	13	–	9	267	289
Anomia simplex d'Orbigny, 1832	55	24	11	15	105
Argopecten gibbus (Linnaeus, 1758)	38	38	6	6	88
Carditamera floridana Conrad, 1846	23	8	24	27	82
Trachycardium egmontianum (Shuttleworth, 1856) juv	16	13	3	9	41
Arcinella cornuta Conrad, 1866	7	14	12	4	37
Ostrea equestris Say, 1834	6	7	8	5	26
Chama congregata Conrad 1833	1	2	9	9	21
Crassostrea virginica (Gmelin, 1791)	5	4	6	4	19
Spisula raveneli (Conrad, 1832) juv	7	–	5	–	12
Mulinia lateralis (Say, 1822)	–	–	–	6	6
Mercenaria campechiensis (Gmelin, 1791) juv	–	3	2	–	5
Tucetona pectinata (Gmelin, 1791)	–	–	4	–	4
Crassinella lunulata (Conrad, 1834)	–	–	3	–	3
Laevicardium pictum (Ravenel, 1861)	1	–	2	–	3
Macrocallista maculata (Linnaeus, 1758)	1	1	1	–	3
Semele proficua (Pulterney, 1799)	3	–	–	–	3
Abra aequalis (Say, 1822)	–	–	2	–	2
Anodontia alba Link, 1807	–	1	–	1	2
Chionopsis intapurpurea (Conrad, 1849)	1	–	–	1	2
Lusciniscа nassula (Conrad, 1846)	–	–	2	–	2
Aequipecten muscosus (W. Wood, 1828)	1	–	–	–	1
Anomalocardia cuneimeris (Conrad, 1846)	–	–	1	–	1
Dallocardia muricata (Linnaeus, 1758)	–	–	–	1	1
Dinocardium robustum (Lightfoot, 1786) juv	–	1	–	–	1
Euvola raveneli (Dall, 1898)	–	–	–	1	1
Pododesmus rudis (Broderip, 1834)	–	–	1	–	1
Raeta plicatella (Lamarck, 1818)	1	–	–	–	1
Tellidora cristata (Recluz, 1842)	–	1	–	–	1
Timoclea grus (Holmes, 1858)	–	–	1	–	1
Transennella conradina Dall, 1884	–	–	1	–	1
GASTROPODA (whole shells)					
Crepidula fornicata (Linnaeus, 1758)	39	16	30	41	126
Crepidula spp. (white)	4	–	–	7	11
Oliva sayana Ravenel, 1834	–	2	7	–	9
Bostrycapulus aculeatus (Gmelin, 1791)	–	1	–	2	3
Cerithium atratum (Born, 1778)	–	1	–	–	1
Chicoreus pomum (Gmelin, 1791) juv	1	–	–	–	1
Prunum apicinum (Menke, 1828)	–	–	1	–	1
Terebra dislocata (Say, 1822)	–	–	–	1	1

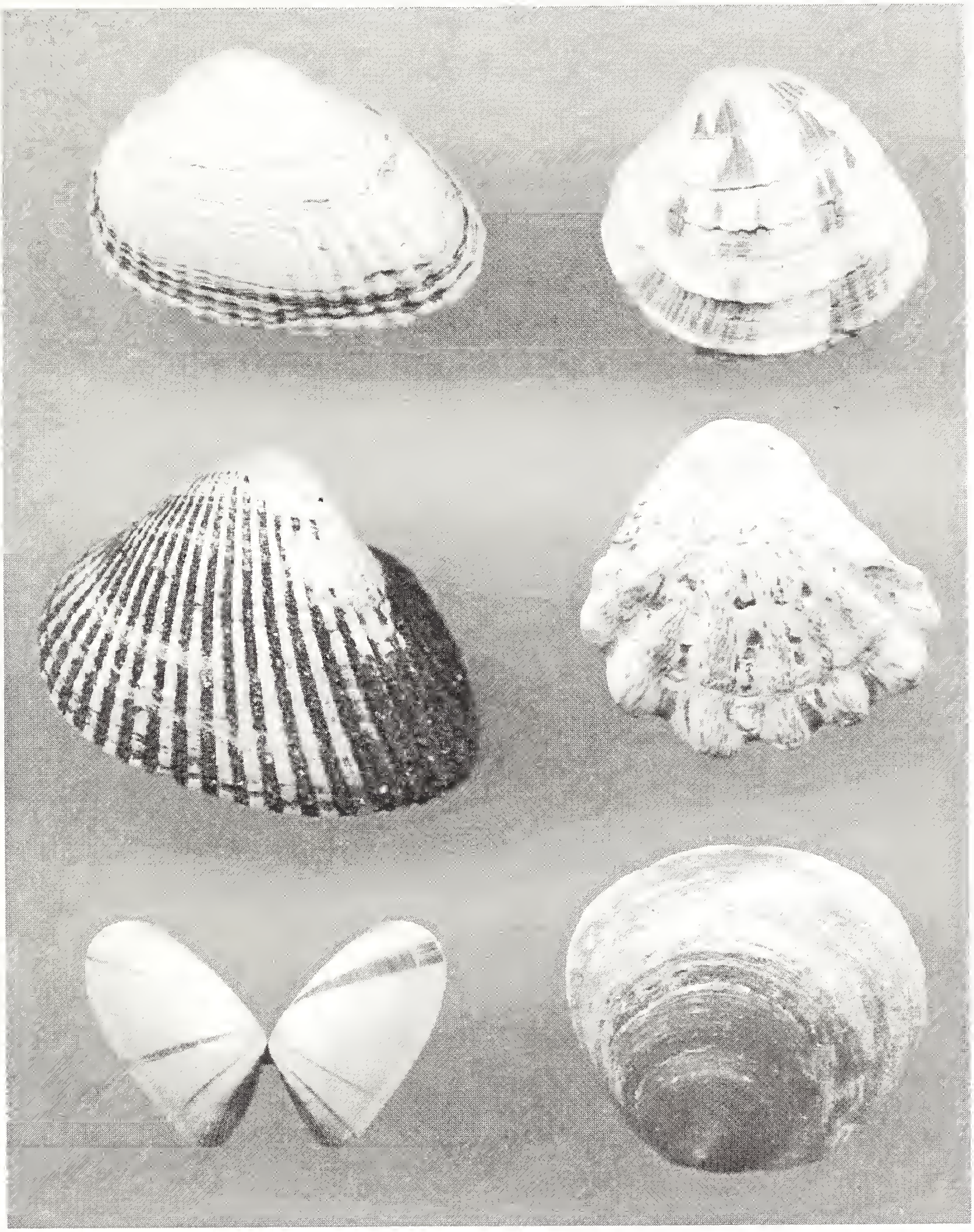

Figure 2: The 6 most common bivalve species in the drift, from left to right and from top to bottom. *Anadara transversa* [30.6 mm], *Chione elevata* [24.8 mm], *Noetia ponderosa* [35.2 mm], *Plicatula gibbosa* [25.2 mm], *Donax variabilis* [18.3 mm], and *Anomia simplex* [27.4 mm].

Results

Bivalve and gastropod numbers are shown separately in Table 1. The scientific names are based on Leal (2012). The species are listed in order of their overall totals, and where this total was the same for two or more different species, those species are placed in alphabetical order. In the case of some larger species, only small juvenile valves were found; this is indicated as "juv" in Table 1. Note that bivalve numbers represent individual valves, so these numbers should be halved when comparing bivalve counts with gastropod counts.

Graphing relative species abundance

A Whittaker plot is a useful way to graphically display relative species abundance (Magurran, 2003). In Whittaker plots, the y-axis represents relative abundance of species using a $\log_{10}$ scale. The x-axis ranks each species in order from most abundant to least abundant; the most abundant is given rank 1, the second most abundant rank 2, and so on. In a Whittaker plot it is necessary to assign a rank even among species in which the number of individuals is the same; in such cases the species were ranked alphabetically (as is also true for the table). The data reveals the curve shown in Figure 1.

In order to place species in the graph, each had to be assigned a ranking. This is straightforward through number 17 (indicated in the list by a dotted line), but after this point it was necessary to arbitrarily assign a rank in cases where the number of individuals was the same for several different species. Within these same-number groupings, the species have been ranked alphabetically.

The plot approximates a "hollow curve", which is typical for biodiversity measurements. Most of the curve here is relatively steep, reflecting striking disparities in abundance The steepest part of the curve represents the most dominant species; the flatter part to the right is the so-called "long tail" of rarer species.

Across all the samples, 18 species were represented by only 1, 2 or 3 valves. If it had been possible to process 15-liter samples, or even 50-liter samples, many additional uncommon and rare species would have been found. One would then expect to see a much longer "tail" since there would have been significantly more valves of those species that are uncommon but not rare. As it is, the final 10 species at the end of the curve include *Aequipecten muscosus* (1 valve) which is not really uncommon, as well as One would then expect to see a much longer "tail" since there would have been significantly more valves of those species that are uncommon but not rare. As it is, the final ten species at the end of the curve include A*equipecten muscosus* (1 valve) which is not really uncommon as well as *Tellidora cristata* (1 valve) which is quite rare (Figure 6). But since the purpose of the study was to learn what the most common species are, the sample size used was appropriate.

The total number of bivalve species in the 4 samples was 35, and the number of gastropod taxa was 8. This clearly represents only a small part of the fauna. In contrast, by spending three hours a day hand picking beach drift for 10 days, I found over 100 species on West Gulf Drive alone including over 35 species of gastropods. However, the only valve of *Tellidora cristata* I found was the one in WGD2. It was not possible to visit Turner Beach in person to hand pick the drift, and I found *Anomalocardia cuneimeris*, *Prunum apicinum*, and *Transennella conradina* only by sorting the Turner Beach material that Pam Rambo had obtained for me (TBBP). Sorting her material revealed several extra species I would not have found otherwise; it is however quite time-consuming.

Hopefully this work is a useful start in examining the composition of the beach drift on an island that is extremely popular with shellers of all kinds. Perhaps more may be learned in the future, by this author or by other researchers.

Acknowledgments

I thank Dr. Jose Leal, director of the Bailey Matthews Shell Museum, for an interesting visit and discussion; Pam Rambo of "iLoveShelling.com" for much practical help and encouragement; Mike Mullins, Commissioner of the Captiva Erosion Prevention District, for information about Blind Pass; and Aydin Orstan of the Carnegie Museum of Natural History for much advice and assistance with the Whittaker plot; and the anonymous reviewer for helpful suggestions about organizing the Results section.

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PROGRAM

PERILS OF PACIFIC PLASTIC POLLUTION: FACTS, MYTHS, AND HOW YOU CAN HELP

The evening's speaker is Miriam Goldstein, a PhD student studying biological oceanography at Scripps Institution of Oceanography. As part of her thesis work she was the chief scientist on the SEAPLEX cruise exploring the plastic debris in the North Pacific Subtropical Gyre. She will discuss the impact of plastic debris on zooplankton communities and invasive species transport in this mid-ocean area.

Meeting date: August 16th at 7:30 PM

CONTENTS

Club news....90
Comments on *Tripterotyphis lowei* (Gastropoda: Muricidae: Tripterotyphinae) with new distribution ranges of the genus from the Panamic Province
SHAWN G. WIEDRICK....91
Book News: Bivalve Seashells of Tropical West America Marine Bivalve Mollusks from Baja California to Perú
RÜDIGER BIELER (reviewer)....94

CLUB NEWS

San Diego Shell Club Meeting
19 July 2012

The meeting was called to order at 7:39 PM by Bob Dees who then introduced the guests attending the meeting. The previous minutes were approved as printed in *The Festivus*. The Treasurer was absent. Corresponding Secretary Marilyn Goldammer announced that the new two-volume set on Panamic Bivalves by Coan and Scott is now in our library available for circulation [see review, this issue, ed.].

Editor Carole Hertz is looking for submission of papers for the *The Festivus*. Carole also reminded members that the Club is asking for donations of shells collected from the Mission Bay Survey in order to provide material to the invertebrate collection at Scripps Institution of Oceanography. These mollusks will serve as reference material for the Survey. This had been announced previously and John Lagrange was the first to donate material.

Vice President David Waller announced that the San Diego Natural History Museum is looking for volunteers to work in the mollusk collection, those interested should contact David.

David Waller introduced the speaker, Dr. Paul Tuskes. Paul presented his second talk in the series on the shells of California. The presentation focused on a number of the smaller genera in our area such as *Latiaxis*, marginellids, ranellids, miters, and larger groups such as spindles, cancellariids, turrids, abalone, nassariids, plus cypraeids and related genera. Images included photos of both collected material and underwater photos of live animals and their habitats. He also discussed their biology and feeding preferences with an emphasis on feeding habits. Of the groups that were discussed, the Turridae contained the most number of species with a few dozen species found from the intertidal zone to the depths.

Debbie Catarius won the door prize. The meeting was then adjourned and those attending enjoyed the refreshments which were provided by Bruce Kemp and Paul Tuskes.

Paul Tuskes

The Festivus Wants You

The Festivus has now been publishing for 42 consecutive years and is always looking for new articles from its subscribers and all others interested in mollusks.

The Festivus, peer reviewed, publishes eleven monthly issues annually (no December issue). Papers are accepted on a multitude of subjects related to mollusks: marine and terrestrial, discussing habitats, anatomy, species comparisons, range extensions, collecting expeditions, meetings on mollusks, new molluscan books and so on. However, *The Festivus* does not include descriptions of new species.

If you are interested in submitting an article, we can supply you with a format sheet. Submit your correspondence and/or paper to Carole Hertz by e-mail < jhertz@san.rr.com >.

The Annual September Party

The big annual September party/potluck will once again be held at the home and garden of Debbie and Larry Catarius at 4173 Galt Street, San Diego, 92111. It will be on Saturday, September 22nd with the festivities beginning at 4 PM. A dinner time is set so that everyone will be able to be there to enjoy the delicious food. It will be at 5:30 PM. Maps to the Catarius address will be available via e-mail – just e-mail jhertz@san.rr.com

This is a very enjoyable event -- pure socializing with old friends and new and seeing the beautiful shells in the Catarius' collection. If you have not signed up to bring a dish (main dish, salad or dessert), contact Carole Hertz at jhertz@san.rr.com.

Hope to see you all there.

Changes to the Roster

New member

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COMMENTS ON TRIPTEROTYPHIS LOWEI (GASTROPODA: MURICIDAE: TRIPTEROTYPHINAE) WITH NEW DISTRIBUTION RANGES OF THE GENUS FROM THE PANAMIC PROVINCE

SHAWN G. WIEDRICK

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The analysis of the species, *Tripterotyphis lowei* (Pilsbry, 1931), was initiated by the author during the days following a trip to Loreto, Baja California Sur, Mexico, taken in December 2009. Several specimens were collected from Bah a Concepcion, Baja California Sur on this excursion and one specimen (Figure 1) did not display the usual flaring varices and measured 13.3 mm. After observing the specimens contained in the Natural History Museum of Los Angeles County (LACM) and the Santa Barbara Museum of Natural History (SBMNH) collections, the Bah a Concepcion specimen seemed especially large in comparison to other mature specimens observed.

Tripterotyphis lowei was originally described by Pilsbry (1931:72) from Bah a Montijo, Panama, and was recorded as measuring 14.5 mm long. The species was not figured until Pilsbry & Lowe (1932: 77, figs 11a,b) illustrated it as a drawing. Keen & Campbell (1964: 56) extended the distribution north to Cabo San Lucas and Guaymas, Sonora, Mexico.

Later that year Shasky & Campbell (1964: 116) published a paper claiming the first live specimen to be collected in the Golfo de California, Mexico. Keen (1971:542) established the range from Cabo San Lucas and Guaymas, Sonora, Mexico, southward to Panama.

Several papers by D'Attilio (1975: 60; 1976: 29; 1982: 95; mention *T. lowei* and detail the morphology and the characteristics of the typhine form. Hertz (1977:40) extended the distribution north to Isla Smith, Bah a de los Angeles, Baja California, Mexico.

D'Attilio and Hertz (1988: figs. 31 a-c) and Robin (2009a: 281, fig. 6) erroneously figured juvenile *T. arcana* DuShane, 1969.

In the process of investigating the literature on *T. lowei*, it was discovered that the true range was more extensive than previously reported. Specimens in the LACM Collection extend the distribution to Puerto San Carlos, Baja California Sur, Mexico, on the Pacific side of Baja California. In addition, the most northern record in the western Golfo de California is from three miles north of Puertecitos, Baja California and on the eastern gulf coast at Punta San Antonio, Sonora.

Specimens in the LACM and SBMNH Collections from Baja California (Figure 2) south through Central America (Figure 3) to Ecuador were analyzed. Mainland specimens and those recorded from offshore islands (other than the Islas Galapagos) do not exceed 14 mm and have thin, fragile varices. Authors who cited records of *T. lowei* from offshore islands in the Panamic Province include Radwin & D'Attilio (1979: 51), D'Attilio & Hertz (1984: 53 & 1988: 43, figs.33 a-c), Shasky (1989: 74), Kaiser (1997: 35) and Kaiser & Bryce (2001: 24) who confirmed the presence of *T. lowei* from samples on Isla del Coco, Costa Rica; Islas Galapagos, Ecuador; and from Isla de Malpelo, Colombia which they figured (pl. 36, fig. 3). D'Attilio & Hertz (1988: 43, figs, 33 a-c) included several line drawings of that species from Islas Tres Mar as, Nayarit, Mexico.

Both papers, however, by D'Attilio (1979: 53, figs. 5, 6) and D'Attilio & Hertz (1984: 53, fig. 7) from Isla Bartolome, Islas Galapagos, show a specimen that appears different than the others

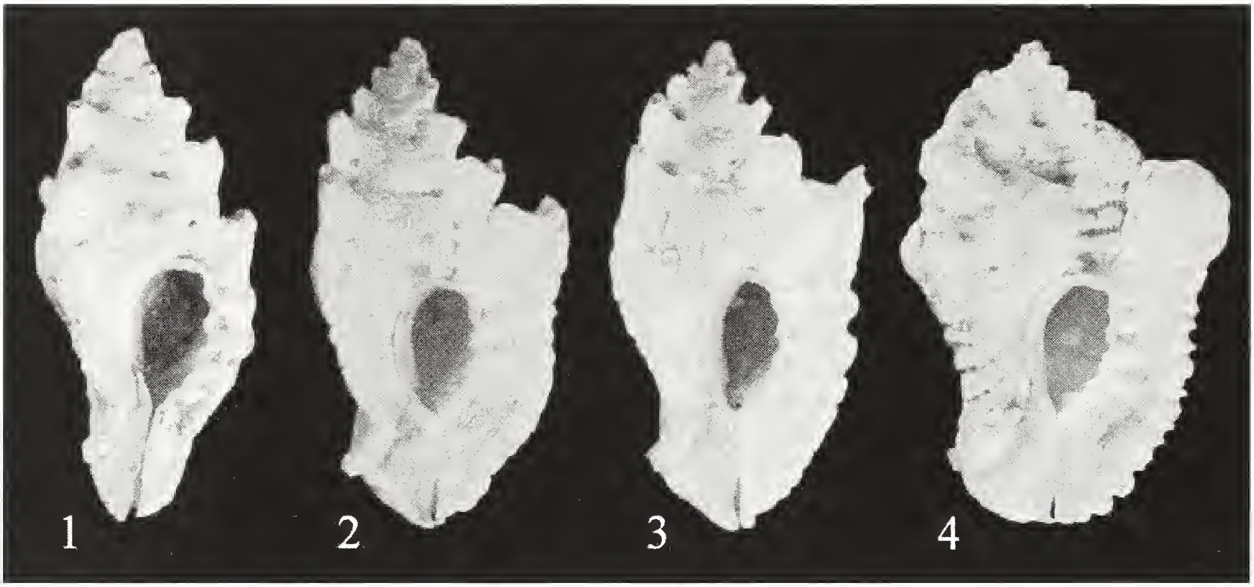
from the Panamic Province studied; whereas the line drawings by D'Attilio *in* D'Attilio & Hertz (1984: 53, fig. 7 d,e) from a specimen at Isla Bartolome is consistent with others in the Panamic Province as are several robust specimens in the LACM and SBMNH collections from the Islas Galapagos (Figure 4).

Due to differences in size and other morphological features, my initial hypothesis was that the specimens from the Islas Galapagos were a separate species from those from other localities within the Panamic Province. However, upon a thorough investigation of spiral morphology (Merle, 1999, 2001, 2005 and Merle & Houart, 2003), as well as confirmation from Roland Houart (pers. comm. 2012), it was determined that those specimens are not new to science but a variation of *T. lowei*.

During the process of investigating *T. lowei* other species from the genus were reviewed. Specimen lots of *Tripterotyphis fayae* (Keen & Campbell, 1963) were observed from the LACM Collection and it was determined that the actual range extends to 40 miles north of Cabo Falso, on the Pacific side of Baja California Sur, Mexico.

Acknowledgments

I thank Lindsey Groves for allowing access to the LACM malacological literature and specimens from the collection. In addition, I thank Daniel Geiger and Paul Valentich-Scott for the loan of material from SBMNH. And finally, I thank James McLean for his patience and assistance with the revisions to this paper.



Figures 1-4. *Tripterotyphis lowei* (Pilsbry, 1931). **(1)** Juvenile, intertidal under rocks, Bah a Concepcion, Baja California Sur, Mexico [SW09-38], height 13.3 mm **(2)** Intertidal, Isla Esp ritu Santo, Golfo de California, Mexico [LACM 74-31], height 12.8 mm **(3)** Isla del Cano, Puntarenas Province, Costa Rica in 25-40 ft. [LACM 72-63], height 10.1 mm **(4)** Under coral at 10-25 m, Isla Floreana, Islas Galapagos, Ecuador [SBMNH 211567] height 26.1 mm.

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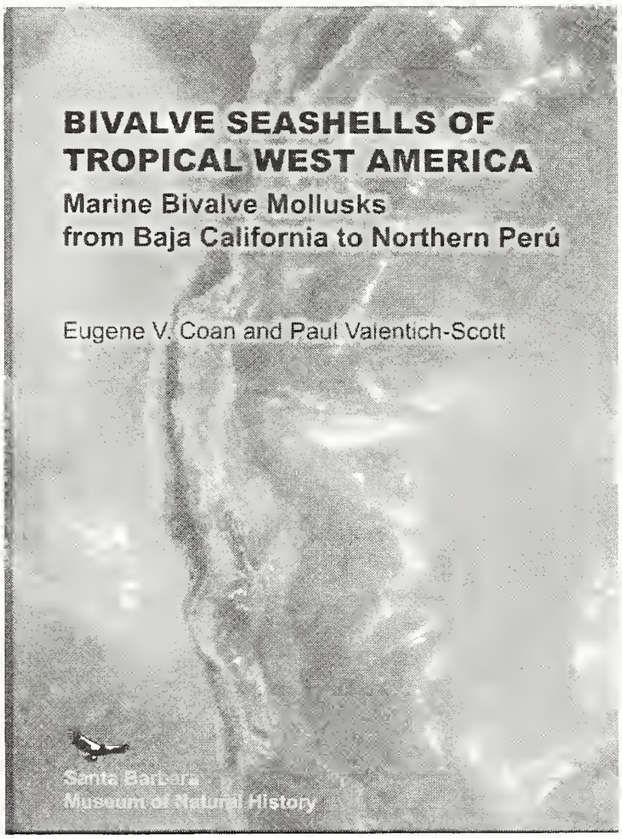
BOOK NEWS

BIVALVE SEASHELLS OF TROPICAL WEST AMERICA
Marine Bivalve Mollusks from Baja California to Northern Perú.
By: Eugene V. Coan and Paul Valentich-Scott. Publication date: 29 February 2012.
Published as: *Santa Barbara Museum of Natural History Monographs* Number 6 and *Studies in Biodiversity* Number 4.
Price: $150.00 (plus shipping) from SBMNH; http://www.sbnature.org/crc/742.html

Bivalve Seashells of Tropical West America is the most comprehensive book ever written on tropical Pacific Ocean bivalves. Dozens of malacological books and monographs appear every year, usually treating a particular molluscan subgroup or providing a more or less complete treatment of species-level diversity in a given region. Few of them are destined to become instant classics that need a prime spot on the malacological bookshelf. This work is undoubtedly one of the latter.

The two authors, Eugene Coan and Paul Valentich-Scott, leading bivalve systematists who know the eastern Pacific bivalve fauna better than anybody else, tailored this work to match their earlier (2000) *Bivalve Seashells of Western North America*, which was coauthored with the late Frank Bernard and provided geographic coverage from the Arctic coast of Alaska to Baja California in Mexico. The present volume, again published by the Santa Barbara Museum of Natural History (SBMNH), extends the range to northern Peru (or Perú as the authors like to call it with a nod to their Spanish language skills) and thus is the long-awaited and much expanded successor of Myra Keen's classic (1971) work covering the same region some forty years ago. The new book's goals are defined as three chief purposes (p. 10): (1) to aid in identification of tropical eastern Pacific bivalves, (2) to provide access to the published information about these and similar taxa, and (3) to pose questions that the authors feel require additional study.

Two things quickly become obvious about this latest contribution: It very closely follows the style of the earlier work, but with 1,258 pages containing over 5,000 photographs, this two-volume tome contained in a sturdy slipcase is much more extensive. The large work is conveniently split into two continuously paginated volumes, each repeating the table of contents and a very detailed index. The introductory material highlights the newly introduced taxa (pp. 3, 4), gives a brief history of Panamic malacology (pp. 9, 10), and introduces the bivalve shell (pp.



Front cover of Volume 1.

11-18). Ten pages (21-31) are dedicated to an excellently illustrated key to superfamilies. The core of the work, beginning on page 32, is dedicated to the group-by-group taxonomic treatment of the regional bivalve fauna in phylogenetic order. The second volume continues the taxonomic section, beginning with the superfamily Tellinoidea. Following the taxonomic treatment, the authors provide an extremely well-researched literature section, including a guide to the bivalve literature (pp. 1034-1044), a massive literature cited section (pp. 1045-1171), and a handy guide to locality names with associated latitudes (pp.

1173-1178). Rounding out the scholarly treatment of the topic, an appendix of image sources is provided that details locales, museum collection numbers, and specimen dimensions of the illustrated shells – thus making every specimen tractable for future research (pp. 1179-1209). The book concludes with a textual glossary of terms (pp. 1210-1222).

A noticeable and welcome shift from the earlier volume is the employment of color photography throughout, all in very good quality and resolution. Patricia S. Sadeghian and Adrianne Calbreath, both of SBMNH, are credited with the excellent digital imaging and page layout, respectively. Minimally, the right outside and left inside valves are shown for each treated species, but in most cases all four views plus an umbonal aspect is provided. In addition, outlines of pallial lines are provided for Tellinidae and Semelidae. Small shells (e.g., in Nuculidae) are represented by scanning electron micrographs. The oblique lighting employed for the color photographs has worked very well, except for the inside of deeper-cupped shells; in groups such as Arcidae, Cardiidae, and Veneridae, interior detail is obscured by the resulting shadows. Technical production is as near-flawless as such a giant tome can be. These authors and their supporters certainly know how to proof-read and cross-reference a publication.

The book concentrates on unraveling and representing species-level diversity in the targeted region, and does so exclusively based on shell-based taxonomy, often illustrating type material. As reflected in the detailed acknowledgment section, input by group specialists was sought where necessary and available. Eighteen new taxa (15 species and three genera) are introduced, often named in honor of bivalve specialists for their contributions to the field. The authors set out to develop a comprehensive guide to the identification of bivalve mollusks in the Panamic Province, and they delivered it exceedingly well.

Throughout the book, the authors are "all taxonomic business" and do not attempt to synthetize the wealth of cited information to venture into more general biological or human interest topics. There is little reference to, and no illustration of, the living animals. Geographic, depth, and fossil record ranges are provided for each species, but no indication of whether the species is rare or common (such data are often difficult to come by, but some of the treated species probably are exceedingly common, whereas others are rarely encountered). The larger and more common ones have probably been exploited for food in the region – which of these many hundred species play or have played a part in the local industrial or artisan fisheries? Questions such as these will be much more readily and accurately addressed with the solid foundation here provided. Between the extremely well-researched taxonomic treatments and the wealth of information linked in the form of thousands of literature citations, Gene Coan and Paul Valentich-Scott have made an amazing contribution to the infrastructure to our field.

This is a must-have for anybody seriously interested in bivalve systematics or the invertebrate fauna of the eastern Pacific. Congratulations to the authors – who will hopefully tackle even more eastern Pacific coastline with the next project. The rest of us better make space on our top shelves. This one requires approximately 3 inches (or 7.5 cm) of shelf. And don't forget to add an extra support bracket for the eleven-pound (!) addition.

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Review by Rüdiger Bieler, Department of Zoology, Field Museum of Natural History, 1400 S Lake Shore Drive, Chicago, IL 60605, USA

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THE FESTIVUS

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Meeting date: third Thursday, 7:30 PM,
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COME TO THE SEPTEMBER PARTY
SEPTEMBER 22nd 2012
4 PM - ? (See p.98 for details.)

There will be no regular meeting this month.

CONTENTS

Club news 98
Range extension for *Erosaria albuginosa* (Mollusca: Cypraeidae)
DAVID B. WALLER 99
Two new books reviewed
ABALONE: Worldwide Haliotidae by Daniel Geiger and Buzz Owen (David Leighton, reviewer) 101
ANTIGUAN SHALLOW-WATER SEASHELLS : A collection with 18 years study and research by Deng Yan Zhang (Susan J. Hewitt, reviewer) 102

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CLUB NEWS

Minutes of the San Diego Shell Club Meeting 16 August 2012

The meeting was called to order at 7:39 PM by Bob Dees. The previous minutes were approved as printed in *The Festivus*. The treasurer was absent so there was no report. Marilyn Goldammer reminded members about the process for checking books out from the library. Carole Hertz reminded members about the September party and passed around a sign-up sheet. Paul Tuskes discussed the shells for the silent auction.

David Waller introduced the speaker for August, Miriam Goldstein, who is a student at Scripps Institution of Oceanography working on her PhD. Her work involves the Pacific Subtropical Gyre and the impact it has on certain marine organisms. This is often described by the press as a "garbage patch" a floating island of plastic and debris 2-3 times the size of the United States.

Miriam started off with photos of the "garbage patch" that have been published by the press, and indeed, they looked horrendous. She then announced that none of the photos were from the Pacific garbage patch. In fact, the average person flying over or sailing through the garbage patch would probably not know it was there. The bulk of the material consists of various types of plastic that range from less than one mm, up to about 10 millimeters. Plastic is in the water column and on/near the surface with an average of nine particles per cubic meter near the surface.

When the size and volume of the area is considered the amount of debris is huge, even though most is too small to be obvious. The two most obvious questions are (1) is it injurious to the marine life and (2) can it be cleaned up. Studies have shown that (1) the small and microscopic bits of plastic are consumed by some filter feeders and small fish. It is not known if the plastic has any toxic effects to those who consume it, but it is clear that it is of no food value and therefore a waste of time, effort, and energy to capture it. Some animals such as flying fish and the marine water strider (insect) may benefit as these animals attach their eggs to floating debris. With current technology (2) the debris cannot be cleaned up.

The problem is that many of the animals that live in this area fall within the same size range as the debris. Thus, the use of nets to catch the debris will also catch and kill the animals. The best solution is to keep plastic and other debris from entering the ocean.

Bob Dees, Wes Farmer and Carole and Jules Hertz provided the snacks for the meeting. The door prize was won by Lisa Deberg.

Paul Tuskes

The Annual September Party, Saturday the 22nd

The big annual September party/potluck will once again be held at the home and garden of Debbie and Larry Catarius at 4173 Galt Street, San Diego, 92111. The festivities will begin at 4 PM. [A dinner time has been set at 5:30 PM so that everyone will be able to be there to enjoy the delicious food.] Maps to the Catarius address will be available on request via e-mail – just e-mail jhertz@san.rr.com

This is a very enjoyable event -- pure socializing with old friends and new and seeing the beautiful shells in the Catarius Collection. If you have not signed up to bring a dish (main dish, salad or dessert), contact Carole Hertz at jhertz@san.rr.com.

Hope to see you all there.

The Festivus Wants You

The Festivus has now been publishing for 42 consecutive years and is always looking for new articles from its subscribers and all others interested in mollusks.

The Festivus, peer reviewed, publishes eleven monthly issues annually (no December issue). Papers are accepted on a multitude of subjects related to mollusks: marine and terrestrial, discussing habitats, anatomy, species comparisons, range extensions, collecting expeditions, meetings on mollusks, new molluscan books and so on. However, *The Festivus* does not include descriptions of new species.

If you are interested in submitting an article, we can supply you with a format sheet. Submit your correspondence and/or paper to Carole Hertz by e-mail < jhertz@san.rr.com>.

RANGE EXTENSION FOR *EROSARIA ALBUGINOSA* (MOLLUSCA: CYPRAEIDAE)

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ABSTRACT: In a recent publication, a range extension for *Erosaria poraria* (Linnaeus, 1758) was described based on six specimens from the Panamic region. Three specimens were collected by H.N. Lowe in the Gulf of California (San Diego Natural History Museum (SDNHM) Lot Nos. 61593 & 42293), one specimen collected from the Galapagos Islands in the R. Negus Collection and two specimens collected by K.L. Kaiser off Clipperton Island (*The Festivus* 44(5): 55-61, figs 1-11). Since these specimens had been misidentified as *E. albuginosa* (Gray, 1825), morphological characteristics were discussed that allowed a clearer distinction between the two species. Specifically, *E. poraria* is distinguished from *E. albuginosa* by having elongated teeth on both the labral and columellar sides of the base, a visible double row of teeth in the fossula, an often distinct deep pitting on either side of the anterior marginal calluses and a narrower anterior aperture. It was concluded that these "...findings have broadened the range of *E. poraria* into the Panamic region and would predict the presence of *E. albuginosa* in the Indo-Pacific." However, no specimens had been identified to support the suggested presence of *E. albuginosa* in the Indo-Pacific.

INTRODUCTION

Recently, three specimens misidentified as *E. poraria* were found in the SDNHM Collection that support this conclusion; one collected in 1913 near Little Santa Cruz Island, Philippines, from the Fred L. Baker Collection (SDNHM Lot Nos. 37194, Figure 1A) and two specimens collected by Joshua L. Baily Jr. in the Fiji Islands (SDNHM Lot No. 43045, Figure 1B). The morphological data of these specimens is presented in Table 1.

Location/ Characteristic	**Philippines**	**Fiji**
Number of specimens	1	2
Shell shape	Pyriform elongate	Pyriform elongate and pyriform
Shell L	17.2 mm	19.6 mm and 19.0 mm
Shell W/L	0.62	0.57 and 0.62
Shell H/W	0.76	0.77 and 0.81
Columellar teeth	17	15 and 14
Labral teeth	15	17 and 16
Fossula teeth	Single row of teeth	Single row of teeth
Basal color	Light violet almost white with distinguishable purple spotting	Light violet almost white with distinguishable purple spotting
Marginal pitting	No pitting	No pitting

Table 1: Morphological data of *E. albuginosa* from the Philippines and Fiji Islands.

CONCLUSION

These specimens of *Erosaria albuginosa* from the Philippines and Fiji have a single row of teeth in the fossula, no pitting on the marginal callus and a wider anterior aperture, which are characteristic of this species. They were likely mislabeled because of their similar dorsal appearance to *E. poraria* and the fact that this species was only known to occur in the Panamic region. The finding of these three specimens provides support for extending the distribution of *E. albuginosa* into the Indo-Pacific.

ACKNOWLEDGMENTS

Special thanks to the reviewers for their comments, the Marine Invertebrate Department at the SDNHM and James Berrian, Field Entomologist at the SDNHM, for allowing access to the Mollusk collection and to Carole Hertz for her help.

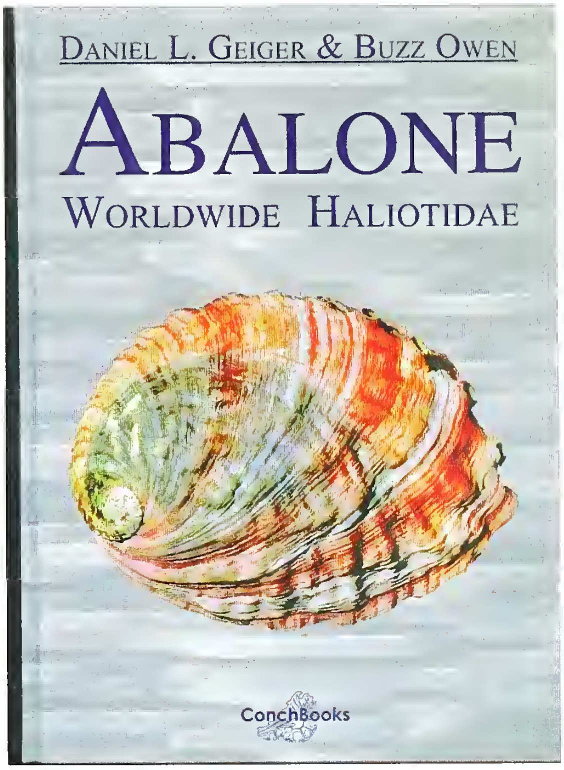
Figure 1. (A) *Erosaria albuginosa* from the Philippines and **(B)** *E. albuginosa* from Fiji.

TWO NEW BOOKS REVIEWED

ABALONE : WORLDWIDE HALIOTIDAE. Hardbound.
By: Daniel L. Geiger and Buzz Owen. 2012
Published: ConchBooks, Hackenheim, Germany.
Price: $140. [Available from the Santa Barbara Museum of Natural History bookstore]

Years in the making, this piece of work is the culmination of dedicated effort by two leading authorities on abalone taxonomy, biology and conchology. Featuring 92 full color plates with accompanying descriptions, shells of all known extant species, subspecies, forms and hybrids of the genus *Haliotis* are shown in vivid detail. The spectacular color plates were all done with utmost care through the photographic talents of Buzz Owen. A wealth of information on the biology, systematics and evolution within the Haliotidae fills the first half of the 361 page book; included therein are a series of plates displaying radular dentition for most species recorded by Daniel Geiger using scanning electron microscopy. To ensure the consideration of all known species and subgroups of *Haliotis* is current, the authors have included appendices, which describe three new subspecies.

Among the supporting diagrams and photographs are several that show fine detail of the epipodium and cephalic tentacles. Features of these structures are highly diagnostic, and where shells may be overgrown with encrustations, form and pigment distribution of the epipodium and its associated structures permit ready identification. Some of the choices involve somewhat distorted preserved material and consequently are less instructive.



Front cover of
ABALONE: WORLDWIDE HALIOTIDAE

The front cover of this handsome book is adorned with an especially attractive shell not specifically identified in the text. It is a hybrid *Haliotis rufescens* x *H. kamtschatkana assimilis* revealing the orange band variation found in a small proportion of the latter. The background of the cover represents the stacked plates of aragonitic crystals in abalone shell nacre observed by electron microscopy.

This book will certainly become a treasure of the conchologist, and a valuable resource to the student of the Haliotidae.

David L. Leighton, reviewer

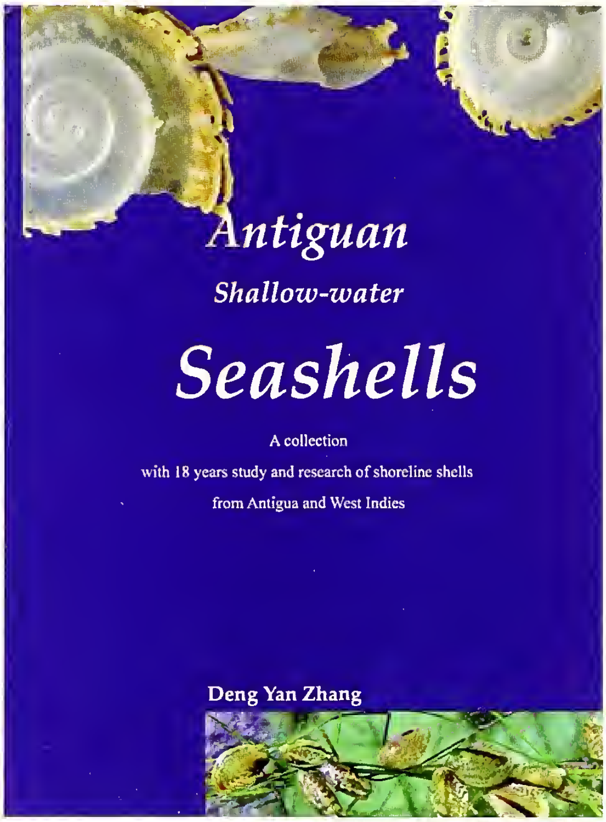
ANTIGUAN SHALLOW-WATER SEASHELLS: A collection with 18 years study and research of shoreline shells from Antigua and West Indies. Hardbound, xi + 211 pp.
By: Deng Yan Zhang. March 2012
Publisher: MdM Publishing, Wellington, Florida.
Price: $100 (from the publisher).

Anyone who is interested in the marine mollusks of the Tropical Western Atlantic will want to see this new 211-page book, approximately 8 by 11 in size, packed with color plates and containing descriptions of 963 taxa which were primarily (but not quite entirely) found around the coast of the island of Antigua, Leeward Islands, West Indies. The taxa are mostly shelled mollusks, including numerous micromollusks, but a fair number of shell-less species are also shown.

The book is beautifully bound with a handsome cover, and the images are all in color and, with very few exceptions, very good. The book is an extraordinary achievement by an author who, 18 years previously, moved to the island of Antigua from China, speaking almost no English, and knowing almost nothing about shells, photography or computers. Deng Yan Zhang had previously been a stamp collector, but walking the beaches of Antigua, he was captivated by the shells he found. Gradually he assembled some literature and learned to identify them. The author's chief inspiration in creating this book was Colin Redfern's masterly 2001 work, *Bahamian Seashells*, featuring 1,000 species from Abaco, Bahamas.

Some very interesting species were found by the author, as is evident from the front cover of the book. The top image shows the tornid *Episcynia inornata* (d'Orbigny, 1842) in fresh condition with its fringed periostracum intact. At the bottom of the front cover is an image of a group of live individuals of a pteriid, an *Electroma* species, a recent invasive in the tropical Western Atlantic, probably introduced in ballast water from the Indo-Pacific.

The great majority of species in the book appear to be correctly identified, and this is partly thanks to a thorough tweaking by citizen scientist Harry G. Lee, who before publication suggested numerous changes. There are still a few questionable identifications: to my eye, taxon 101 from Saint Kitts is *Turritella variegata*, not *Torcula acropora*, and the beach worn shell shown on page 116 as 381(1-2) seems to be



Front cover of the Antiguan Seashells book

Dermomurex alabastrum, rather than *D. pauperculus*. A 22-item errata sheet is included and available from the publisher at http://www.mdmshellbooks.com and through Amazon Books.

It would have been helpful to know something about the author's collection techniques and also to have brief habitat notes for the live-collected taxa. I also would have preferred that the illustrated shells not actually found on Antigua had been included in an appendix rather than integrated into the text. A few of the more spectacular species were collected in St. Kitts and Nevis, St. Lucia, Barbuda, Grenada,

Trinidad, and Guyana and not on Antigua.

Although the author understood that his written English was imperfect, the publisher decided to leave the text as it was written, so as not to tamper with the author's underlying ideas. I believe the book would have benefitted from thorough copy editing and proof reading. Within the technical shell descriptions, the author's English is adequate only some of the time. The few pieces of continuous prose such as the dedication, author's introduction, acknowledgements, and the two paragraphs on the back cover, all could have used a helping hand.

The virtues of the book do, however, outweigh its difficulties, and is certainly worth the approximately $100 it costs when bought from the publisher, which surprisingly is currently less than the Amazon price.

Susan J. Hewitt, reviewer

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THE FESTIVUS

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PROGRAM

The Distinguishing Characters that Separate the Genera in the Cypraeidae

Club member David Waller, a specialist in cowries, will be the evening's speaker. He will discuss the characters defining the different genera in the Cypraeidae and the bases on which they were created, illustrating his discussion with his fine photography.

Come to the Annual Book and Reprint Sale

Meeting date: October 18th at 7:30 PM

CONTENTS

Club news...106
A six-hour survey of the marine mollusks of the Island of Montserrat, Leeward Islands, West Indies
SUSAN J. HEWITT 107

CLUB NEWS

The Annual September Party

The big annual September party/potluck was once again held at the home and lovely patio/garden of Debbie and Larry Catarius. Guests began to arrive at 4 PM for this very enjoyable event -- pure socializing and eating great food with old friends and new and seeing the beautiful shells in the Catarius Collection.

The twenty members attending had a great time. The food was delicious (as always) and the desserts were just sinful enough to keep everyone very happy. And the Catarius' patio makes people feel like they'd better get busy on their own yards! Plumeria everywhere, and other beautiful flowering and non-flowering plants. And then, of course, there's the Catarius shell collection. It took a while but soon people were crowded around looking at the beautiful shells.

As always, this is a great and relaxing party. Our thanks, once again, to Debbie and Larry for hosting this event.

The XVII Annual SCUM Meeting Returns to LACM!!

The seventeenth annual meeting of the Southern California Unified Malacologists (SCUM) will return to the LACM on January 19, 2013 from 8:00 AM to 4:00 PM.

This seventeenth annual gathering will convene in the Times Mirror Room (ground floor) of the Natural History Museum of Los Angeles County in an informal meeting of professional, student and amateur malacologists as well as molluscan paleontologists.

This is a unique organization, the purpose of which is to facilitate contact and keep one another informed of research activities and opportunities. There are no dues, no officers and no publications!

The doors will open at 8:00 AM. Parking is free but there are no in and out privileges.

Tentative schedule:

8:00 AM – 9:00 AM: Meet and greet with coffee, tea and pastry items.
9:00 AM - 12:00 PM: Announcements, introductions and short informal presentations.
12:00 PM: Group photo.
12:15 PM - 1:30 PM: Lunch break (at the NHM Grill or other local eateries).
1:30 PM – 3:30 PM: More presentations.
3:30 PM- ?? Malacology Collection access/tours.

You are asked to RSVP as soon as possible to help those in charge in preparing for the meeting.

For further information and/or questions on parking, overnight accommodations, on presentations, equipment, or directions to LACM, see the notice on e-mail concerning the SCUM meeting, or contact either one of us privately. Please do not reply to this announcement as it will be distributed to dozens of our molluscan colleagues. Instead contact Lindsey Groves at (lgroves@nhm.org) and/or Mary Stecheson at (msteches@nhm.org.

New Book Announcement

The Festivus has received an announcement of the publication of ***The Sea Shells of Greece*** by Thanasis Manousis, published by Kyriakidis Brothers s.a. [e-mail: info@kyruajudus,gr]

The notice states that the book is bilingual, both in English and Greek, of 380 pages, hard cover with 120 pages of text and with full color illustrations. The publication discusses about 1200 species from Greek waters with 1800 digital illustrations and 180 digital drawings.

The Club's Annual Christmas Party

This year the Club's annual dinner party will be held on Saturday December 1st. It will again be at the Butcher Shop in Kearny Mesa by popular demand.

Festivities begin at 5:00 PM with no host cocktails, dinner to be served at 6:00 PM. Please save the date for this fun event. Menu selections will be announced at the October meeting and included in the November issue of *The Festivus.*

The Annual Book and Reprint Sale

Each October the Club presents its annual book and reprint sale – a time to get some publications for your library or a head start on gifts for the holidays. The sale is on the honor system – choose your book or periodical and put the money in the jar.

The proceeds from the book and reprint sale are used to buy new books for the Club library.

A SIX-HOUR SURVEY OF THE MARINE MOLLUSKS OF THE ISLAND OF MONTSERRAT, LEEWARD ISLANDS, WEST INDIES

SUSAN J. HEWITT

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Introduction

The island of Montserrat is mostly steep and mountainous and situated at 16°45'N, 62°12'W. It is part of the inner arc of the northern half of the Leeward Island chain of the Lesser Antilles, West Indies (Figure 1). It is 62 km southeast of the island of Nevis, which has been my main focus of study during annual visits since 1997.

Figure 1. A map of the Lesser Antilles from Hispaniola to Venezuela, with an inset of Montserrat. LB = Little Bay, DB = Carrs Bay, triangle = Soufrière Hills, the active volcano; dotted line = northern edge of the exclusion zone on land (the marine exclusion areas are not marked on this map).

In 1995, Montserrat's Soufrière Hills volcano, previously dormant, became active and remains active. Pyroclastic flows and volcanic mudflows have destroyed almost all the settlements and the infrastructure in the southern part of the island, including Plymouth, the capital and port on the western side and the airport on the east coast. Some of the volcanic outpourings have spilled into the Caribbean Sea and the Atlantic Ocean, radically impacting the near-shore underwater ecology and noticeably extending the coastline in those areas. The eruptions have rendered more than half of the island too dangerous to inhabit or to travel in the "exclusion zone" (Figure 1). Only the northern part of the island is still green, pleasantly habitable and legally accessible, although subject to periodic ash-falls. A new airport was built, there is a new seaport on the west coast at Little Bay and a new center of government at Brades, 1.5 km south-southeast of Little Bay.

Rosenberg (2009) shows only 14 marine molluscan species listed for Montserrat, very few of which are common intertidal or shallow subtidal species, so I was interested in trying to record more. During the time I would be on Nevis during the 2011 trip, a rare day trip to Montserrat was offered. The ferry boat "Sea Hustler" would take three hours to reach the island, and passengers would have approximately six hours to spend there. To ensure that I would have the necessary permits, I applied to the Government of Montserrat, for a Memorandum of Understanding to cover my research. Gerard Gray, Director of the Environment, processed my application and issued the memorandum.

I was accompanied on the trip by my friend Nicole "Nikki" Johnson, who lives on Nevis, is familiar with the local marine molluscan fauna, and is expert at searching beach drift. I also needed Nikki's physical support because I had torn a

Figure 2. Looking to the south end of Little Bay from the water.

Figure 3. Looking north along Carrs Bay.

ligament in my knee a week before. We arrived at the new port in Little Bay (Figure 2).

The Caribbean coast of Montserrat features cliffs with sandy bays interspersed, in contrast to that of Nevis where the west coast has an almost continuous sandy shore. I could neither walk long distances nor climb rough trails, so our searching was confined to Little Bay (16°48′05″N, 62° 12′20″W) and Carrs Bay (16°47′50″N, 62° 12′30″W), 0.5 km to the southwest.

On Little Bay I recorded living mollusks on the rocks of the port jetty, and Nikki and I carefully searched the sparse drift on the sand beach of the bay. At the south end of Little Bay, Dive Master Troy Deppermann and his wife Melody Schroer of the Green Monkey Dive Shop let us use their center as our headquarters. Troy told us about mollusks he had seen underwater; he also let us sort through a cigar box of shells gathered on local dives and keep any we found interesting.

Gerard Gray met me at Little Bay to give me another document, an export permit he thought I might need, and he drove us south around the headland to Carrs Bay, which also has a sandy beach (Figure 3). On Carrs Bay, Nikki and I searched the beach drift and I recorded a few species of living mollusks on rock surfaces protruding from the sand in the center of the beach.

Results

Nikki Johnson (N) and I (SJH) found dead shells or fragments in beach drift except where noted. Identifications are by me except for species observed live during SCUBA dives by Troy Depperman (TD).

Analysis

In all, 89 taxa of marine mollusks were recorded on our visit, comprising 57 gastropods, 28 bivalves, 1 chiton and 3 cephalopods. *Tegula excavata* is the only species which was already listed for the island of Montserrat in Rosenberg (2009). I observed and identified 7 species of live intertidal gastropods on rocks.

Little Bay has an impressive headland which protects it from northerly swells and winds. The beach drift there was very sparse in volume, but surprisingly rich in species (51), many of which were represented only by shell fragments or by small shells.

Carrs Bay is wide open with no large headlands to protect it; the beach drift there contained fewer species (41), but out of that total, 20 were new additions to the list.

I have not included on the list a freshwater cerithioidean, *Mellanoides tuberculata* (O. F. Müller, 1774), three shells of which were found in the beach drift on Carrs Bay, where three rivers empty into the sea. This species has been introduced in many areas worldwide including some small Caribbean islands (Bass, 2003). In 1996, Dr. Bass found this snail in six out of the ten freshwater sites he sampled on Montserrat (pers. comm, February 2012).

Ten species are shown on the list solely on the basis of shells I examined that Troy Depperman had brought back from dives; these do not all date from 2011, but none are older than 2003. Three of the shells are shown in Figure 4. Troy told me that he had many other shells at his home some miles away, but I was not able to examine that material. Of the live mollusks that Troy reported seeing during dives, I have included a few shelled species and three shell-less species that I feel are distinctive enough for me to trust Troy's identifications. *Sepioteuthis sepiodea*, the reef squid, is distinctively cuttlefish-like in appearance, as its scientific name implies. *Elysia crispata*, the lettuce slug, a sacoglossan, is also distinctive; there are no similar Caribbean species in the same genus. *Octopus vulgaris*, the common octopus, can be distinguished from *Octopus joubini*, *O. briareus* and *Amphioctopus burryi,* three other Caribbean shallow-water octopus species, by its large size, and arms that are not webbed.

Many of the species I am reporting for Montserrat are common in the Lesser Antilles, but some are uncommon. Rosenberg (2009) shows no records between the Virgin Islands and north of Brazil for *Bursa corrugata, B. rhodostoma thomae* (text figure 4), and *Hesperato maugeriae*. However, Díaz & Puyana, (1994) and others have recorded these three species from Colombia. *Pisania pusio* (Figure 4), although generally a common and widespread species in the Caribbean, had no (Rosenberg 2009) records south of the Virgin Islands and north of St. Vincent.

Five valves of *Transennella* species were found on Little Bay. One damaged valve was the distinctive and colorful species *T. gerrardi*. Of the remaining four valves, three were chipped and beach-worn, but all are whitish and rounded trigonal in outline. This shape is characteristic of both *T. cubaniana* and *T. culebrana*, two of the rarer (Mikkelsen & Bieler, 2008) species of Caribbean *Transenella*. There are images and descriptions of these two species in Redfern, 2001 (species 970, 971, p. 238, pl. 102) and in Mikkelsen & Bieler, 2008 (p. 318).

The best preserved of the four valves is 5.8 mm in length. It is fresh and relatively undamaged, although there are small grains of sediment caught between the hinge teeth. It is rounded trigonal in outline, white, with purple on the umbones and five

Figure 4. Shells found on dives by TD: left, *Semicassis cicatricosum*, 63.5 mm; top right *Bursa rhodostoma thomae*, 28.2 mm; lower right *Pisania pusio*, 38.2 mm.

small, purple triangular marks spaced around the entire shell margin as well as small faint flecks of brown seen with enhanced contrast" as shown in Figure 5. The outer surface is not very glossy, with relatively weak commarginal sculpture which is somewhat eroded in the center of the valve. Because the shell is not as trigonal as *T. culebrana*; because the outer surface has flecks of brown and other color markings not seen in *T. culebrana*; and because the commarginal ridges are visible throughout its surface, this is identified as *T. cubaniana*.

Conclusions

The 89 marine molluscan species that are new records for Montserrat, when added to the pre-existing Rosenberg 2009 list of 14 species, brings the overall total to 103. This is a good start in assessing the marine molluscan fauna of the island, as well as being a respectable result for a short visit to the island's two most accessible beaches. The Montserrat marine molluscan fauna appears to be rich, and it should not be difficult to expand the list further. I hope to have the opportunity to make another visit.

List of the Marine Mollusks of Montserrat 2011

Notes: LB = Little Bay; CB = Carrs Bay; A = observed alive by SJH; T = empty shells brought back from dives by Troy Depperman; TA = species reported alive on dives by Troy Depperman; M = listed in Rosenberg, 2009. Scientific names are taken from Rosenberg, 2009.

GASTROPODA	
Lottidae	
Lottia morphotype B (as per Hewitt, 2009)	LBA
Lottia albicosta (C.B. Adams, 1845)	LBA
Patelloida pustulata (Heibling, 1779)	LB
Tectura antillarum (Sowerby I, 1843)	LB, CB
Fissurellidae	
Diodora listeri (d'Orbigny, 1842)	LB, CB
Diodora minuta (Lamarck, 1822)	CB
Fissurella angusta (Gmelin, 1791)	LB
Fissurella barbouri Pérez Farfante, 1943	LB
Fissurella nodosa (Born, 1778)	LB
Fissurella rosea (Gmelin, 1791)	CB
Hemitoma emarginata (Blainville, 1825)	LB
Hemitoma octoradiata (Gmelin, 1791)	CB
Lucapinella suffusa (Reeve, 1850)	LB
Trochidae	
Cittarium pica (Linnaeus, 1758)	LB, CB,TA
Tegula excavata (Lamarck, 1822)	M, LB, CB
Turbinidae	
Lithopoma caelatum (Gmelin 1791)	CB
Lithopoma tuber (Linnaeus, 1767)	CB
Neritidae	
Nerita tessellata Gmelin, 1791	LBA, CB
Nerita versicolor Gmelin, 1791	LBA
Planaxidae	
Hinea lineata (da Costa, 1778)	LB
Cypraeidae	
Erosaria acicularis (Gmelin, 1791)	CB, T
Macrocypraea sp.	TA
Talparia cinerea (Gmelin, 1791)	CB, T
Ovulidae	
Cyphoma gibbosum (Linnaeus, 1758)	TA
Littorinidae	
Echinolittorina angustior (Mörch, 1876)	CBA
Echinolittorina tuberculata (Menke, 1828)	CBA
Echinolittorina ziczac (Gmelin, 1791)	LBA, CBA
Strombidae	
Eustrombus gigas Linnaeus, 1758	LB, CB,TA
Tricornis raninus Gmelin, 1791	T
Naticidae	
Polinices lacteus (Guilding, 1834)	T
Tonnidae	
Cassis tuberosa (Linnaeus, 1758)	TA
Cypraecassis testiculus (Linnaeus, 1758)	T
Semicassis cicatricosum (Gmelin, 1791)	T
Tonna pennata (Mörch, 1852)	T
Bursidae	
Bursa corrugata (G. Perry, 1811)	LB
Bursa rhodostoma thomae (d'Orbigny, 1847)	T
Ranellidae	
Cymatium martinianum (d'Orbigny, 1846)	CB
Hipponicidae	
Hipponix antiquatus (Linnaeus, 1767)	LB
Triviidae	
Hesperato maugeriae (Gray, 1832)	LB
Vermetidae	
Serpulorbis decussatus (Gmelin, 1791)	CB
Buccinidae	
Gemophos tinctus (Conrad, 1846)	LB, CB
Pisania pusio (Linnaeus, 1758)	LB, CB, T
Columbellidae	
Columbella mercatoria (Linnaeus, 1758)	LB, CB
Nitidella nitida (Lamarck, 1822)	LB
Nassariidae	
Nassarius sp.	LB
Fasciolariidae	
Leucozonia nassa (Gmelin, 1791)	LB
Muricidae	
Coralliophila caribaea Abbott, 1958	LB, CB
Plicopurpura patula (Linnaeus, 1758)	CB
Mancinella deltoidea (Lamarck, 1822)	LB
Mitraeidae	
Mitra nodulosa (Gmelin, 1791)	LB
Olividae	
Oliva reticularis Lamarck, 1791	LB, CB
Conidae	
Conus mus Hwass, 1792	LB, CB
Conus regius Gmelin, 1791	LB, CB
Terebridae	
Hastula cinerea (Born, 1778)	LB, CB
Bullidae	
Bulla striata Bruguière, 1792	LB
Placobranchidae	
Elysia crispata Mörch, 1863	TA
BIVALVIA	
Arcidae	
Acar domingensis (Lamarck, 1819)	LB
Arca imbricata (Bruguière, 1789)	LB, CB
Fugleria tenera (C.B. Adams, 1845)	LB
Noetiidae	
Arcopsis adamsi (Dall, 1886)	CB
Glycymerididae	
Glycymeris undata (Linnaeus, 1758)	T
Tucetona pectinata (Gmelin, 1791)	LB
Pteriidae	
Pteria colymbus Röding, 1798	T
Limidae	
Ctenoides mitis (Lamarck, 1807)	CB, TA
Lima caribaea d'Orbigny, 1853	LB

Ostreidae		Veneridae	
Dendrostrea frons (Linnaeus, 1758)	LB	*Lirophora paphia* (Linnaeus, 1767)	T
Plicatulidae		*Transennella cubaniana* (d'Orbigny, 1852)	LB
Plicatula gibbosa Lamarck, 1801	CB	*Transennella gerrardi* Abbott, 1958	LB
Anomiidae		Tellinidae	
Anomia sp.	CB	*Arcopagia fausta* (Pulteney, 1799)	T
Pectinidae		*Strigilla carnaria* (Linnaeus, 1758)	T, CB
Caribachlamys sentis (Reeve, 1853)	LB	*Strigilla mirabilis* (Philippi, 1841)	LB
Spondylidae		*Tellina radiata* (Linnaeus, 1758)	LB
Spondylus ictericus Reeve, 1856	LB, CB	POLYPLACOPHORA	
Lucinidae		Chitonidae	
Ctena orbiculata (Montagu, 1808)	LB	*Chiton squamosus* Linnaeus, 1758	LB, CB
Parvilucina costata (d'Orbigny, 1846)	LB, CB	CEPHALOPODA	
Chamidae		Spirulidae	
Chama congregata Conrad, 1833	LB, CB	*Spirula spirula* Linnaeus, 1758	CB
Chama sarda Reeve, 1847	CB	Loliginidae	
Chama sinuosa Broderip, 1836	CB	*Sepioteuthis sepioidea* (Blainville, 1823)	TA
Cardiidae		Octopodidae	
Laevicardium pictum (Ravenel, 1861)	LB	*Octopus vulgaris* Cuvier, 1797	TA
Papyridea semisulcata (Gray, 1825)	CB		

Acknowledgments

This research would have been impossible without the help of Nicole Johnson. I very much appreciate the kindness of Gerard Gray, Director of Environment, for the MoU and the export letter, and for driving us to Carrs Bay. Many thanks to Troy Deppermann and Melody Schroer of the Green Monkey Dive Shop for their generosity and hospitality. Thanks to the people of Montserrat for a friendly greeting. The information from Gary Rosenberg's database Malacolog 4.1.1 is provided with the permission of the ANSP. A sincere thank you to the anonymous reviewer, who carefully edited the paper and corrected the identification on the *Transenella* species. The map was prepared with the expert help of Ron Hartley.

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Figure 5. An inner and an outer view of the 5.8 mm valve identified as *Transennella cubaniana*.

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PROGRAM
Sand Diving in Hawaii

Paul Tuskes will be the speaker for November. He and his wife Ann make annual migrations to Hawaii for diving, shells, and underwater photography. During their recent September trip they spent the majority of their time in Puako and Anaho'omalu Bay on the Kona side of the big island where they focused on snorkeling the sand patches rather than the reef. Paul will show photos of the live animals, talk about how these snails make a living and how to find them during the day.

The silent auction will feature Hawaiian shells.

Meeting date: November 15th at 7:30 PM

CONTENTS

Club News 114
Polygyra cereolus (Mühlfeld, 1818) (Gastropoda: Polygyridae), the Southern Flatcoil, a recently introduced species in southern California
LINDSEY T. GROVES & PHIL LIFF-GRIEFF 115
Report of the combined 45th annual meeting of The Western Society of Malacologists and the 4th International Workshop on Opisthobranchs.
ALEX SASSI 124
A selected index to volume XLIV (2012)
JULES HERTZ (compiler) 129

CLUB NEWS

Minutes of the San Diego Shell Club 18 October 2012

The meeting was called to order at 7:45 PM by Bob Dees, President. After visitor introductions the previous minutes were approved as published. Librarian Marilyn Goldammer encouraged members to support the book and reprint sale that started prior to the meeting. Proceeds go toward new books for the library. The treasurer was absent so there was no report. Carole Hertz (editor) reminded members that we are always looking for good papers to publish.

Bob Dees announced the slate of officers for 2013. The Club board is the nominating committee and placed the following names in nomination: President, David Waller; Vice President, open; Corresponding Secretary, Marilyn Goldammer; Recording Secretary, Paul Tuskes; Treasurer, Silvana Vollero. If you are interested in the VP position please contact David Waller.

David Waller gave an outstanding presentation on the taxonomic status of the Cypraeidae. In the past, all cowries were placed in one genus, *Cypraea*. The number of species is unclear but 250 is a reasonable estimate at the moment. Most of us seem to have missed it, but during the period from 1922 to 1993 numerous authors published taxonomic schemes and included no fewer than 43 genera and as many as 61 genera to supplement the genus *Cypraea*. A 2004 study that involved mitochondrial DNA settled on 46 genera, a number similar to the more conservative papers that focused on animal and shell morphology, ecology, and distribution patterns. David illustrated these points with various species.

A notable function of systematics is to provide an organizational structure for the millions of plant and animal species that have been described. In the Cypraeidae, six genera address about 48% of the species, with the remainder split into 40 genera. The common theme of the presentation might have been: Which provides better organization and understanding of the taxa involved, one genus with numerous subgenera for close evolutionary groups or 46 separate genera? The pros and cons for each approach were discussed by the speaker. The criteria for creating a new genus is at the center of the issue. Is it really as simple as statistical analysis of DNA data or the presence/absence of morphological features? The overall discussion probably warrants a paper and went beyond what can be published in the minutes.

Jules Hertz won the door prize, and refreshments were provided by Bob Dees, Wes Farmer and Marilyn Goldammer. The meeting was adjourned at 8:40 PM, but the book and reprint sale continued.

Paul Tuskes

The Club's Annual Christmas Party

This year the Club's annual Christmas dinner party will be held on Saturday December 1st. It will again be at the Butcher Shop in Kearny Mesa, by popular demand. Festivities will begin at 6:00 PM with no host cocktails. Dinner will be served at 7:00 PM. Please save the date for this fun event.

The menu for the evening will be: Classic Caesar Salad, dinner rolls and butter, Prime Rib of Beef with new potatoes or mesquite broiled fresh Mahi Mahi served with wild rice. Both entrees will be accompanied by fresh vegetables. Vegetarian entrees are available. Dinner will be accompanied by table wines. Dessert will be New York style cheese-cake with strawberry sauce and coffee or tea.

The program for the evening will be presented by Richard Herrmann – title not known at this time – but it's always great talk anyway. Remember to bring a wrapped gift to place under the tree for the gift exchange – a shell or shell related item with data on the inside but only general locality on the outside. This is a tradition of the Club, so enjoy it by participating.

The cost of the entire evening will be $30. Reservations (with check) must be received by November 26th. If you wish to include your membership renewal for 2013 with your reservation, that will be fine. Membership will be the same for 2013 ($20 domestic).

Dues are due

Dues for 2013 are now due. There is no change in the amount from the past number of years: $20 (domestic); Overseas (air mail): $50; Mexico/Canada (air mail) $30.00. Please send your check to the Club address (see front page) or bring it to the January meeting.

POLYGYRA CEREOLUS (MÜHLFELD, 1818) (GASTROPODA: POLYGYRIDAE), THE SOUTHERN FLATCOIL, A RECENTLY INTRODUCED SPECIES IN SOUTHERN CALIFORNIA

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Abstract: A recent invasive species of land snail, *Polygyra cereolus* (Mühlfeld, 1818), the Southern Flatcoil, is here documented from Los Angeles, Orange, and Riverside counties, southern California. It is native to Florida and the southeastern United States, however, living specimens and empty shells have been collected from the Fossil Reef Park area of Laguna Hills, Orange County, from the North Campus area of the Natural History Museum of Los Angeles County (LACM), and from Cathedral City and Rancho Mirage, Riverside County. Sod and/or potted plants for landscaping are the suspected method of transport for these new records.

Introduction

Non-native land snails in southern California are mentioned as early as 1850 by Forbes (1850:53) regarding the presence of *Cornu aspersum* (Müller, 1774) at Santa Barbara. This report was later disputed by Stearns (1881:131; 1900:656) and he demonstrated that the introduction of *C. aspersum* occurred no earlier than 1856 near San Jose, California. Other significant non-native species in southern California, all of which are now widespread, include *Otala lactea* (Müller, 1774) from Los Angeles in 1940 (Gammon, 1943; Hill, 1951) and Elysian Park and Playa del Rey, Los Angeles County in 1941 (Hill, 1941; 1951), *Theba pisana* (Müller, 1774) from near La Jolla, San Diego County in 1914 (Chace, 1915; Hill, 1951), *Milax gagates* (Draparnaud, 1801) in Los Angeles, Orange, and San Diego counties (Gregg, 1944), *Rumina decollata* (Linnaeus, 1758) as early as 1951 (Hill, 1951), and *Discus rotundatus* (Müller, 1774) in Santa Barbara, Ventura, Los Angeles, and San Diego counties (Roth, 1982). Hanna (1966) summarized introduced terrestrial, freshwater, and marine species. Since then Roth & Sadeghian (2006) list 38 non-native species in California. Of the 43 taxa they list from Los Angeles County 17 are introduced and four are exclusively Pleistocene fossils. They list 18 taxa from Orange County eight of which are native, 10 are introduced, and one is found only as a fossil. Of the 31 taxa they list from Riverside County 25 are native and six are introduced. For a complete listing of native and introduced species of land snails and slugs in California see Roth & Sadeghian (2003; 2006). These numbers are, of course, subject to change due to new biological surveys, closer examination of museum collections, and publications subsequent to Roth & Sadeghian (2006). Table 1 is a compilation of native and non-native

species by county from Roth & Sadeghian (2003; 2006), McDonnell, et al. (2009), Magney (2010; 2012), and the Rancho La Brea Invertebrate and LACM Malacology collections. This summary does not include any species and/or subspecies found exclusively on the Channel Islands.

Polygyra cereolus (Mühlfeld, 1818) is here documented for the first time in California (figs. 1a-1c) from LACM 2011-13.5 (Orange County), LACM 178492 (Los Angeles County), and LACM 2012-1.1 (fig. 2), 2012-1.2, LACM 178538, and LACM 178539 (Riverside County). The family Polygyridae is native to California as at least 20 species of the genus *Vespericola* are known from Del Norte to San Luis Obispo counties and at least five species and four subspecies of the genus *Trilobopsis* are known from Del Norte to Tulare counties (Roth & Sadeghian, 2006). However, the tribe Polygyrini is absent from west of the Rocky Mountains (K. Perez, pers. comm., 2012).

Systematics

Superfamily Helicoidea Rafinesque, 1815
Family Polygyridae Pilsbry, 1895
Subfamily Polygyrinae Pilsbry, 1895
Genus *Polygyra* Say, 1818

Polygyra cereolus (Mühlfeld, 1818)
Figures 1a-1c, 2

Helix cereolus Mühlfeld, 1818:11, pl. 2, figs. 18a-b.
Helix microdonta Deshayes, 1832:266.
Helix volvoxis Pfeiffer, 1846:80.
Helix cereolus var. *laminifera* Binney, 1858:200.
Helix carpenteriana Bland, 1860:138.
Helix febigeri Bland, 1866:373, pl. 21, fig. 10.
Polygyra cereolus (Mühlfeld, 1818): Binney, 1878: 283, fig. 161. 81. Pilsbry, 1940: 582-586, fig. 379. Stern & Vander Weit, 1982:129-130. Hubricht, 1985:36. Neubert, 1995:125-126, fig. 1. Cowie, 1996: 26. Cowie, 1997:26-27. Cowie, 1998:355, 361. Cowie, 1998b: 60. 1998b; Shelton, 1998:7. Cowie, 2000:158, 170. White, 2003:21. Minton & Perez, 2005:4. Jass, 2007:3. Al-Khayat, 2008: 543, fig. 6. Perez et al., 2008:46.
Helix (Polygyra) cereolus (Mühlfeld, 1818): Dall, 1885:265-267.
Polygyra septemvolva var. *floridana* Hemphill *in* Binney, 1892: 184.
Polygyra septemvolva floridana Hemphill, 1892: Pilsbry, 1940: 586-587, fig. 380.
Polygyra (Polygyra) cereolus cereolus (Mühlfeld, 1818): Thompson, 2008: 823-824. Thompson, 2011: 249.

Geographic Distribution

Although Pilsbry (1940) cited only Florida for the range of *Polygyra cereolus*, the current confirmed range includes most of Florida (Dall, 1885; Hubricht, 1985), much of coastal Alabama (Hubricht, 1985; Shelton, 1998), Louisiana (Hubricht, 1985; Minton & Perez, 2005), Georgia (Dall, 1885; Hubricht, 1985), Mississippi (Dall, 1885; Hubricht, 1985), and South Carolina (Hubricht, 1985). It is also common in coastal Texas and several inland counties (Hubricht, 1985). In addition to all of the southeastern records, Perez (2008) included Kentucky and North Carolina. Thompson (2011) documented records from Yucatan, Quintana Roo, and San Luís Potosí, Mexico. Dall (1885) lists *P. cereolus* from the Bahamas and Bermuda but only Terrestrial Mollusc Tool (http://idtools.org/id/mollusc/(factsheet.php?name=Polygyra%20cereolus) includes these islands and Cuba as part of the range but unconfirmed). More recently *P. cereolus* has been introduced in Wisconsin (Stern & Vander Weit, 1982; Jass, 2007), O'ahu, Hawai'i, and Kau'ai, Hawaiian Islands (Cowie, 1996, 1997, 1998a, 1998b, 2000), Qatar (Al-Khayat, 2010), Saudi Arabia (Neubert, 1985), and United Arab Emirates (Anonymous, 2006). It should be noted that many of these records are restricted to coastal plains and/or isolated areas rather than intrusions into undisturbed habitats. Most of these range extensions are attributable to sod and/or ornamental plant transport. Undoubtedly, additional new records of *P. cereolus* will be discovered in southern California in the near future.

Associated Molluscan Faunas

Five other species of mollusks were collected by the authors at Fossil Reef Park, Orange County in-Cluding *Cornu aspersum* (Müller, 1774), *Otala lactea* (Müller, 1774), *Rumina decollata* (Linnaeus, 1758),*Oxychilus draparnaudi* (Beck, 1837), and an unidentified slug species. In the NHMLAC North Campus Area *Lehmannia valentiana* (Férussac, 1821) was observed under rocks with *P. cereolus.* At the Cathedral City, Riverside County locality *P. cereolus* was collected with *Rumina decollata* and *Lehmannia valentiana.*

Locality Descriptions

The junior author was alerted to the presence of *P. cereolus* at the Orange County site by N. Scott Rugh, Temecula, California, who collected specimens on 13 January, 2008. Eight live specimens were collected by overturning limestone blocks. A one acre site of limestone outcrops of the middle Miocene Topanga Formation surrounded by a large apartment complex was preserved by Orange County, California as Historical Site no. 28 and is known as Fossil Reef Park (LACM 2011-13). The Los Angeles County specimen was collected live by LACM staff member Lila Higgins on 10 March, 2012 and given to the senior author for identification which was confirmed as *P. cereolus*. The North Campus of LACM is currently still under construction but when completed it will serve as a 3.5 acre outdoor laboratory for educational purposes and the study of biodiversity in urban Los Angeles (LACM 178492). Records from Riverside County were brought to the attention of the junior author by NHMLAC Malacology Research Associate Patrick I. LaFollette in 2011. Live and empty shells were collected from under rocks and flower pots on his property in Cathedral City in March of 2010 and March of 2012 (LACM 2012-1) and collected in the yard of emeritus Invertebrate Paleontology curator Edward C. Wilson of Rancho Mirage in April of 2012 (LACM 178538 & LACM 178539).

Figure 1 a-c. *Polygyra cereolus* (Mühlfeld, 1818) preserved specimen from Orange County (LACM 2012-13.1). (a) apical view (b) umbilical view (c) apertural view of same specimen. Shell maximum width = 6.9 mm.

Fossil Distribution

The family Polygyridae is known as early as the Paleocene of Alberta, Canada and southern China (Tracey, et al., 1993). True *Polygyra* are known from Miocene (formerly Oligocene) strata of Florida (Dall, 1915), Pliocene/Pleistocene deposits of Florida (Johnson, 1899; Dall, 1890; Henderson, 1935) and Pleistocene deposits of Kansas (Taylor, 1960), Texas (Cheatum & Fullington, 1971), Illinois (Leonard et al., 1971), and Mexico (Stevens et al., 2012). Miocene and older records of *Polygyra* outside of Florida may prove to be other polygyrid genera as many specimens are too poorly preserved for a confident generic assignment. Dall (1890:19) and Henderson (1935:13, 47, 143) reported *P. cereolus microdonta* (Deshayes, 1839) (as Dall) from the Pliocene Caloosahatchie beds of Florida. These beds are now considered latest Pliocene/Pleistocene (Piacenzian through Calabrian) (Petuch & Drolshagen, 2011).

Although not fossils, Wheeler & McGee (1994) reported *P. cereolus* from a Late Archaic midden site in Volusia County, Florida and White (2003) reported it from at least one Late Archaic midden in Franklin County, Florida dated at 4000 years old at about 2100 BC. As previously mentioned, the family Polygyridae is native to California as represented by the genera *Vespericola* and *Trilobopsis* but a fossil record in the state is unknown.

Acknowledgments

Special thanks and gratitude to N. Scott Rugh (Temecula, California), Patrick I. LaFollette (Cathedral City, California and LACM Research Associate), and Lila Higgins (LACM Education & Exhibits, Project Coordinator) who shared specimens and locality information with the authors. Many thanks to Harry Lee (Jacksonville Shell Club, Florida) for confirming our identification of this newest non-native gastropod in California. Kathryn E. Perez (University of Wisconsin, La Crosse) is thanked for valuable information concerning *P. cereolus* distribution, providing pertinent literature suggestions, and reviewing an early draft of the manuscript. Cathy L. Groves (LACM, Echinoderms) assisted with Excel data manipulation.

Figure 2. *Polygyra cereolus* (Mühlfeld, 1818). Live specimen from Riverside County (LACM 2012-1.1). (Image courtesy of P.I. LaFollette).

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Table 1. Terrestrial mollusks from Los Angeles, Orange, and Riverside counties

(Compiled from Magney (2010; 2012), McDonnell et al. (2009), and Roth & Sadeghian (2003; 2006). [x = Roth & Sadeghian (2003; 2006); * = Non-native species; LACM = Natural History Museum of Los Angeles County, Malacology Collection; MPG = McDonnell et al., 2009; DLM = Magney (2010; 2012); f = Pleistocene fossil species (Roth & Sadeghian, 2003, 2006; x & f = living and Pleistocene species (Roth & Sadeghian, 2003, 2006); f (RLB) = Pleistocene fossil species from Rancho La Brea not listed in Roth & Sadeghian (2003, 2006) (see Lamb, 1989)].

TAXA	Los Angeles Co.	Orange Co.	Riverside Co.
PATULIDAE Tryon, 1866			
Discus (D.) whitneyi (Newcomb, 1864)	f		
**Discus (Patula) rotundatus* (Müller, 1774)	x	x	
HAPLOTREMATIDAE Baker, 1925			
Haplotrema (Geomene) caelatum (Mazÿck, 1886)	x		
SPIRAXIDAE Baker, 1939			
**Euglandina (Euglandina) rosea* (Férrusac, 1821)			x
HELMINTHOGLYPTIDAE Pilsbry, 1939			
Sonorelix (S.) rixfordi (Pilsbry, 1919)			x
Chamaearionta aquaealbae (Berry, 1922)			x
Herpeteros angelus (Gregg, 1949)	x		
Xerarionta (X.) kelletti (Forbes, 1850)	x		
Cahuillus indioensis cathedralis (Willett, 1930)			x
Cahuillus indioensis indioensis (Yates, 1890)			x
Cahuillus indioensis wolcottianus (Bartsch, 1903)			x
Cahuillus indioensis xerophilus (Berry, 1922)			x
Eremarionta (E.) brunnea (Willett, 1935)			x
Eremarionta (E.) immaculata (Willett, 1937)			x
Eremarionta (E.) millepalmarum (Berry, 1930)			x
Eremarionta (E.) morongoana (Berry, 1929)			x
Eremarionta (E.) orocopia (Willett,1939)			x
Eremarionta (E.) rowelli chuckwallana (Willett, 1935)			x
Eremarionta (E.) rowelli granitensis (Willett, 1935)			x
Eremarionta (E.) rowelli mccoiana (Willett, 1935)			x
Helminthoglypta (Charodotes) traskii pacoimensis Gregg, 1931	x		
Helminthoglypta (Ch.) traskii traskii (Newcomb, 1861)	x	x	
Helminthoglypta (Ch.) uvasana Roth & Hochberg, 1992	x		
Helminthoglypta (Ch.) vasquezi Roth & Hochberg, 1992	x		
Helminthoglypta (Coyote) fontiphila Gregg, 1931	x		
Helminthoglypta (Co.) petricola sangabrielis (Berry, 1920)	x		
Helminthoglypta (Co.) petricola zechae (Pilsbry, 1916)	x		
Helminthoglypta (H.) tudiculata convicta (Pilsbry, 1913, ex Hemphill ms)	x		
Helminthoglypta (H.) tudiculata subdola (Hemphill, 1890)			x
Helminthoglypta (H.) tudiculata tudiculata (A. Binney, 1843)		x	x
HELICIDAE Rafinesque, 1815			

**Cepaea nemoralis* (Linnaeus, 1758)	x		
**Eobania vermicularia* (Müller, 1774)	DLM		x
**Cornu aspersum* (Müller, 1774)	x	x	x
**Otala lactea* (Müller, 1774)	x	x	
**Theba pisana* (Müller, 1774)	LACM	LACM	
POLYGYRIDAE Pilsbry, 1895			
**Polygyra cereolus* (Mühlfeld, 1818)	LACM	LACM	LACM
MEGOMPHICIDAE Baker, 1930			
Glyptostoma gabrielense Pilsbry, 1938	x		
Glyptostoma newberryanum mimus Pilsbry, 1939			x
Glyptostoma newberryanum newberryanum (W.G. Binney, 1858)		x	
SUCCINEIDAE Beck, 1837			
Catinella (Mediappendix) rehderi (Pilsbry, 1948)	x	f	
Catinella (M.) vermeta (Say, 1829)	x & f		x
Oxyloma retusum (Lea, 1834)			x
Oxyloma sillimani (Bland, 1865)	x		x
**Novisuccinea ovalis* (Say, 1817)	x		
PUNCTIDAE Morse, 1864			
Paralaoma servilis (Shuttleworth, 1852)	x	x	
Punctum californicum Pilsbry, 1898	x & f (RLB)		x
Punctum minutissimum (Lea, 1841)	x		
ARIONIDAE Cooper, 1863			
**Arion (Kobeltia) distinctus* Mabille, 1868			MPG
**A. (K.) hortensis* Férussac, 1819			MPG
**A. (K.) intermedius* Normand, 1852			x
Anadenulus cockerelli (Heilprin, 1890)	x	x	
Hesperarion hemphilli (W.G. Binney, 1875)	x	x	
PRISTILOMATIDAE Cockerell, 1891			
Hawaiia miniuscula (A. Binney, 1841)	x		x
Pristiloma (P.) gabrielinum (Berry, 1924)	x		
EUCONULIDAE Baker, 1928			
Euconulus (E.) fulvus (Müller, 1774)	f (RLB)		
GASTRODONTIDAE Tryon, 1866			
Striatura (Pseudohyalina) pugetensis (Dall, 1895)	f	x	x
Zonitoides (Z.) arboreus (Say, 1816)	x & f		x
DAUDEBARDIIDAE Kobelt, 1906			
**Oxychilus (O.) cellarius* (Müller, 1774)	x		
**Oxychilus (O.) draparnaudi* (Beck, 1837)	x	x	
MILACIDAE Ellis, 1926			
**Milax (Milax) gagates* (Draparnaud, 1801)	x	x	MPG
LIMACIDAE Rafinesque, 1815			
**Lehmannia valentiana* (Férussac, 1821)	x	x	x
**Limax (Limacus) flavus* Linnaeus, 1758	x	x	MPG
**Limax (Limax) maximus* Linnaeus, 1758	x	x	

AGRIOLIMACIDAE Wagner, 1835			D
**Deroceras (Agriolimax) reticulatum* (Müller, 1774)	x		MPG
Deroceras (D.) monentolophus Pilsbry, 1944	x	x	
**Deroceras invadens* Reise, Hutchinson, Schunack, & Schlitt, 2011 [formerly *Deroceras panormitanum* (Lessona & Pollonera, 1882)]	x		
Deroceras (D.) laeve (Müller, 1774)	f (RLB)		
CIONELLIDAE Clessin, 1879			
Cochlicopa lubrica (Müller, 1774)	x		
PUPILLIDAE Turton, 1831			
Pupilla (Pupilla) hebes (Ancey, 1881)	f		
VERTIGINIDAE Stimpson, 1851			
Gastrocopta (G.) pellucida (Pfeiffer, 1841)			x
Sterkia (Sterkia) hemphilli (Sterki, 1890)	x		
Vertigo (V.) occidentalis Sterki, 1907	f		
VALLONIIDAE Morse, 1864			
Vallonia cyclophorella Sterki, 1892	f (RLB)		
**Vallonia excentrica* Sterki, 1893	x		
**Vallonia pulchella* (Müller, 1774)	x	x	
FERRUSSACIIDAE Bourguignat, 1883			
**Cecilioides (Cecilioides) acicula* (Müller, 1774)	x		
SUBULINIDAE Crosse & Fischer, 1877			
**Rumina decollata* (Linnaeus, 1758)	x	x	x

REPORT OF THE COMBINED 45TH ANNUAL MEETING OF THE WESTERN SOCIETY OF MALACOLOGISTS AND THE 4TH INTERNATIONAL WORKSHOP ON OPISTHOBRANCHS

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Nestled among redwood trees and commanding a view of Monterey Bay, the campus of the University of California at Santa Cruz was the site of this year's annual meeting of the Western Society of Malacologists (WSM) and the fourth International Workshop on Opisthobranchs (IWO). The WSM meeting was organized by WSM President Janet Leonard (Joseph M. Long Marine Laboratory, University of California Santa Cruz) and the IWO by Angel Valdés (Department of Biological Sciences, California State Polytechnic University). Attendees hailed from places near and far from the Pacific Coast, from Alaska along the coastal provinces and states to Baja California Sur, westward to Australia, and eastward to Europe (Figure 1). There were 32 oral presentations in simultaneous sessions of the WSM and IWO, and 15 posters were presented. (Figure 2). Sessions were held from June 24 to 26. This year's field trip on the 27th was a fossil-collecting trip led by Charles Powell (U.S. Geological Survey) to Arroyo Seco in Monterey County, where late Miocene deep-water mollusks can be found.

Within the WSM meeting were two symposia, one on the History of Malacology of the Northeast Pacific and the other on Terrestrial Gastropods. I attended most of the talks in the WSM sessions and the last set of talks in the IWO. In the following I summarize some of the personally interesting or noteworthy information from the presentations I attended. By no means do I attempt to summarize the complete work and conclusions of the authors, and the information related here comes from my notes and the book of abstracts.

An ice cream social began the events on a sunny Sunday afternoon on the campus. Later that evening, Terry Gosliner of the California Academy of Sciences kicked off the program, speaking of the Academy's Hearst Expedition to the Philippines. Objectives of the expedition included, among others, discovering new taxa, developing new techniques in animal husbandry, and disseminating the results quickly to a broad and general audience. The marine work was conducted just about 2.5 hours from metro Manila by car, and resulted in the discovery of many new species. For example, about 50 new nudibranchs were discovered in about four-weeks time. Terry showed pictures of many colorful animals and plants that were found and also explained techniques of collection, such as the "coral clothesline," where pendant bags of coral samples were suspended along a line kept buoyant by air-filled plastic bottles, thus keeping the coral safe from bacterial contamination on the substrate. It is estimated that over 500 species were discovered. The expedition was covered by numerous Filipino and U.S. media, including a Northern California Emmy® Award-winning television documentary, *Reefs to Rainforest: The Great Expedition.* (http://abclocal.go.com/kgo/video?id=8404396).

Monday began with a fascinating set of talks on the history of malacology in the N.E. Pacific, organized by Hans Bertsch (Departamento de Ingenería y Pesquerías, Universidad Autónoma de Baja California Sur). Carlos Cáceres Martinez (Universidad Autónoma de Baja California Sur) spoke about his studies of mother-of-pearl breastplates found in the burial sites in Baja California. These breastplates were made of shells of *Pinctada mazatlanica* (Hanley, 1856) that had been variously polished, burnished, or engraved, and were found in association with burials of children. Mother-of-pearl objects found in burials of adults were noticeably different, being much smaller and having serrated edges, and these were placed on the outside of the body cavity instead of inside as for the children. Eugene Coan and Paul Valentich-Scott (Department of Invertebrate Zoology, Santa Barbara Museum of Natural History) reviewed the history of marine bivalve research in the Panamic Province, acknowledging the contributions of many people. They also described the

Figure 1. Participants of the 45th Western Society of Malacologists Meeting. Photo courtesy of Dr. Hans Bertsch.

huge effort involved in the research, writing, editing, and proofreading of their latest two-volume series, *Bivalve Seashells of Tropical West America*. Doug Eernisse (Department of Biological Science, California State University, Fullerton) showed evidence he has gathered for the existence of an "extra" species of *Siphonaria* (siphon limpet) in the Sea of Cortez, based on evidence from molecular studies, which supports the validity of an older name. He also spoke briefly of the Hawaiian *Siphonaria* and the one species in California (yes, we have a *Siphonaria*!).

Hans Bertsch continued the historical perspective, reviewing the paths of five naturalists: Johann Friedrich Eschscholtz, Robert E. C. Stearns, James Graham Cooper, Theodore Dru Alison Cockerell, and William Henry Dall. All five of these naturalists named opisthobranchs and other taxa, and they all had species named in their honor. It was fascinating to learn about these familiar names and their interwoven paths with historical figures and events, such as Ulysses S. Grant and the Great Kanto earthquake of 1923, which devastated Tokyo. Nora Foster (NRF Taxonomic Services) described the work of George MacGinitie, whose studies of the Arctic fauna were all the more impressive considering how specimens were collected, including relying on Inupiaq navigation techniques, and dog-pulled dredges through sea ice. She also shared some of her experiences surveying mollusks in the Chukchi Sea and showed many photographs of Arctic mollusks, including some lovely *Margarites* sp. and *Boreotrophon* sp.

Monday afternoon's session was a set of contributed papers. Lesley Brooker (Faculty of Science, Health, Education, and Engineering, University of the Sunshine Coast) described her research into the genes that control biomineralization of chiton radula, a particularly good model because the mineralization progresses along the length of the radula. Using techniques of modern molecular biology, they have identified several genes that seem important in regulating biomineralization functionality. Carlos Cáceres Martinez reported on work to elucidate what environmental factors affect the growth of *Pteria sterna* (Gould, 1851). The technique involves the laborious

Figure 2. Participants of the 4th International Workshop on Opisthobranchs. Photo courtesy of Dr. Hans Bertsch.

preparation of pieces of shell so that the space between microscopic growth lines can be measured.He explained that, unfortunately, no correlations have been found yet. The distance between two adjacent lines corresponds to one day's growth.

The next series of talks focused on surveys of species in several areas of Mexico. Gabriel Aguilar (Laboratorio de Malacologia, Instituto de Ciencias del Mar y Limnología, Universidad Autónoma de México) spoke of a survey of Isla Verde in the state of Veracruz. *Cerithium litteratum* (Born, 1778), *Lithopoma tectum* (Lightfoot, 1786), and *Modulus modulus* (Linnaeus, 1758) were the most common species found. Esteban Félix-Pico (Centro Interdisciplino de Ciencias Marinas del Instituto Politécnico Nacional) described a visual, underwater survey of the island of Espíritu Santo done by free diving. Because of restrictions in the marine preserve, the surveyors could not turn rocks or remove species. *Pinctada mazatlanica* was the most abundant bivalve, and *Muricanthus nigritus* (Philippi, 1845) the most abundant gastropod. Iris Garcia Tello (Facultad de Ciencias, Universidad Autónoma de México) spoke of a survey of many sites throughout the Bahía deAcapulco. Approximately 10,000 specimens were counted of about 184 species. Micromollusks were the most abundant. Brian Urbano (Laboratorio de Malacología, Instituto de Ciencias del Mar y Limnología, Universidad Autónoma de México) spoke of one of his student's work studying scaphopods of México and the difficulties encountered in studying this often over-

looked and not well-studied group.

Monday's sessions concluded with two talks related to fisheries management. Marian Camacho-Mondragón (Centro Interdisciplino de Ciencias Marinas, Instituto Politécnico Nacional) described her work in La Paz towards establishing a minimum take size for the harvest of the pen shell, *Atrina maura* (Sowerby, 1835). Individuals were taken, measured, and their gonads removed. The gonads were then fixed in paraffin and stained for histologic examination under a microscope. Her findings indicate that *A. maura* in La Paz, Baja California Sur, does not have a resting period between spawning and the development of more gametes. This was attributed to the plentiful food available throughout the year. Additionally, her findings indicate that during the summer months when the water is warm, *A. maura* re-absorbs the ripe oocytes instead of spawning, presumably because the water temperature is too high for survival. Kristin McCully (Department of Ecology and Evolutionary Biology, University of California, Santa Cruz) spoke about her work researching the pearl oysters of Midway Island for *Pinctada margaritifera* (Linnaeus, 1758), formerly harvested commercially at the neighboring atolls of Pearl and Hermes. She reported that *P. margaritifera* was rare, with only 13 sighted over six years. Spat collected on shade cloth catches seem to be *Pinctada maculata* (Gould, 1850), according to DNA evidence.

Contributed papers finished Tuesday with a presentation by Wendy Enright (City of San Diego Marine Biology Laboratory). She described the monitoring in and around two wastewater outfalls in the San Diego area, both 7 km offshore, and presented findings from her studies of the populations of the invasive gastropod *Philine auriformis* Suter, 1909, and the native bivalve, *Solemya pervernicosa* Kuroda, 1948 using present and historical data. The outfall areas turned out not to be an attractant for *P. auriformis*, whose observed population density was noted to go through booms and busts. *Solemya pervernicosa* was associated with the location of the outfall, as might be expected by the relatively higher concentration of sulfides near the outfalls, but it was also found at higher density at other locations in the Bight.

Following the contributed papers was the symposium on terrestrial gastropods organized by Janet Leonard and John Pearce (Joseph M. Long Marine Laboratory, University of California Santa Cruz). Tim Pearse (Section of Mollusks, Carnegie Museum of Natural History) gave the first presentation. He discussed the potential effects of climate change on populations of snails, making particular note of two ways in which a species might suffer: either by having to migrate to higher altitude or by having to migrate to higher latitudes in order to find a suitable environment. He then summarized data on Pennsylvania land snails obtained in the field and from museum collections in terms of altitude and cited a few case studies. In the following presentation, Edna Naranjo-García (Instituto de Biología, Departamento de Zoología, Universidad Autónoma de México) gave an update and overview of what is known about the terrestrial mollusks of the state of Chiapas in México, including her recent fieldwork. She has found records of 128 species in Chiapas, 54 of which had been reported only once. One large and well-known species, *Lysinoe ghiesbreghti* (Nyst, 1841) is eaten and can be purchased at the markets of San Cristóbal de Las Casas when in season. She concluded that the knowledge is still inadequate and suggested areas of Chiapas for particular focus. She also described the threats to the habitat from agriculture, cattle farming, and destruction of vegetation along riverbanks.

Angela Fields (The Department of Biological and Chemical Sciences, The University of the West Indies) introduced the audience to the mating behavior of the slug *Veronicella sloanei* (Cuvier, 1817), an invasive slug and garden pest in Barbados, with text, photos, and video. *Veronicella sloanei* is a simultaneous hermaphrodite and was observed to mate in couplets and uncommonly in triplets. The species sometimes shows mate selection. Barry Roth dedicated his presentation on the diversity of terrestrial mollusks in the Pacific Northwest to Terrence Frest, who passed away in 2008. He showed maps of records of terrestrial mollusks and reported that there are many new species to be described from the forests of the area.

I then switched gears and attended the final talks of the IWO. The first presentation I attended was by Jeff Goddard (Marine Science Institute, University of California, Santa Barbara), who spoke on the legacy of field data recorded by James Lance, who continued to study the opisthobranchs in the La Jolla/San Diego area for 33 years after his last published paper. His record keeping was described as both extensive and meticulous, and Jeff expressed gratitude that these records had not met their fate in the garbage can after the death of James Lance. As an example of their utility, Jeff showed data gathered from these records that shows evidence of the disappearance of *Felimare californiensis* (Bergh, 1879) on the mainland of California.

Hans Bertsch then presented another informative overview of the history of opisthobranch studies in the Sea of Cortez up to the present day. The expedition of

John Steinbeck and Ed Ricketts initiated the phase of most activity, and attention increased even further after 1960. He also gave an overview of his monitoring of opisthobranch populations of Bahía Los Ángeles, a project he began in 1984 at several areas in the bay. In this area, Steinbeck and Ricketts had recorded four species, and now more than 80 species have been found.

Slugging Pole to Pole was the title of the presentation by photographer Kevin Lee, who took us on an illustrated travelogue of many of his trips around the globe. His photography was stunning, and he had so many photos to share that he ran out of time and finished his presentation only after the official end of the ISO. It was clear that he goes to great lengths to get the perfect shot, including braving surging waters and leopard seals. After taking the audience from tropical seas to the cold waters of the Arctic and Antarctic, he ended by showing pictures of beautiful nudibranchs that he took using a point-and-shoot camera off the shores of California, demonstrating that one doesn't need to go far to see beauty.

The last presentation I attended was Maria Moreno-Alcántara's (Universidad Autónoma de Baja California Sur) report on a survey of holoplanktonic mollusks in the Golfo de Tehuantepec (Oaxaca, México), where 40 species were found. These mollusks were most abundant in the deeper, mixed layers of water caused by eddies in the gulf created by the weather and wind patterns there.

After Tuesday's presentations, the group assembled under redwood trees for a group photo and then headed inside for the banquet. The two cakes decorated with the design for the meetings drew much attention and many snapshots.

Figure 3. Attendees viewing posters at one of the evening sessions.

The eating, drinking, and conversation in many languages continued until almost 11:30 P.M., attesting to the friendships formed, old and new.

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ABSTRACTS OF THE WESTERN SOCIETY OF MALACOLOGISTS
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A SELECTED INDEX TO VOLUME XLIV (2012)

BERTSCH, HANS (reviewer)
Book news: Russian Opisthobranchs (reviewed) 40
BIELER, RÜDIGER (reviewer)
Book news: Bivalve Seashells of Tropical West America Marine Bivalve Mollusks from Baja California to Perú 94
FORSYTH, ROBERT G. & PATRICK WILLISTON
Terrestrial snails from an urban park in Vancouver, British Columbia 77
GARCÍA, EMILIO F.
Clathodrillia phasma (Schwengel, 1940) (Gastropoda: Drilliidae), an east Florida species reported herein from three quadrants of the Gulf of Mexico 65
GROVES, LINDSEY T. & PHIL LIFF-GRIEFF
Polygyra cereolus (Mühlfeld, 1818) (Gastropoda: Polygyridae), the Southern Flatcoil, a recently introduced species in southern California 115
HERMOSILLO, ALICIA & CAROLE M. HERTZ
The opisthobranch fauna of Isla Guadalupe, Mexican Pacific 35
HERTZ, CAROLE M. (editor)
Montage from the March meeting 45
In Memoriam: John Arthur Bishop, MD 62
A pictorial view of the fun at the recent San Diego Shell Club Auction/potluck 73
HERTZ, CAROLE M. & JULES HERTZ (compilers)
References with molluscan information on Mission Bay, San Diego, California (other than those in Tuskes, 2012) 30
HERTZ, JULES (compiler)
Low tides for 2012 at San Felipe, Baja California, México 9
A selected index to Volume XLIV (2012) 129
HEWITT, SUSAN J
A five-minute survey of marine mollusks from the island of Antigua, Leeward Islands, West Indies 7
Further surveys of the marine mollusk fauna of the island of St. Kitts, Leeward Islands, West Indies, Part I 68
A five-minute survey of marine mollusks from the island of Antigua, Leeward Islands, West Indies 81
A six-hour survey of the marine mollusks of the Island of Montserrat, Leeward Islands, West Indies 107
HEWITT, SUSAN J (reviewer)
Book news: Antiguan shallow-water Seashells by Deng Yan Zhang 102
JACKSON, EMMA & CHRISTINA TORRES
Pharmaceuticals at sea: effects of the pharmaceutical Ibuprofen on embryonic development of *Stronglocentrotus purpuratus* 3
KRONENBERG, GIJS
Gibberules gibbosus (Röding, 1798) (Caenogastropoda: Strombidae) from the Islas Galápagos? 46
LEIGHTON, DAVID (reviewer)
Book news: Abalone Worldwide Haliotidae by Daniel L. Geiger & Buzz Owen 101
SASSI, ALEXANDER P.
A few observations on the seashells of Rapa Nui (Easter Island) 48
Report of the combined 45th Annual Meeting of The Western Society of Malacologists and the 4th International Workshop on Opisthobranchs 124
TUSKES, PAUL M.
Survey of Mission Bay mollusks, San Diego, California 13
WALLER, DAVID B.
Range extension for *Erosaria poraria* (Mollusca: Cypraeidae) 55
Range extension for *Erosaria albuginosa* (Mollusca: Cypraeidae) 99
WIEDRICK, SHAWN G.
Comments on *Tripterotyphis lowei* (Gastropoda: Muricidae: Tripterotyphinae) with new distribution ranges of the genus from the Panamic Province 91

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